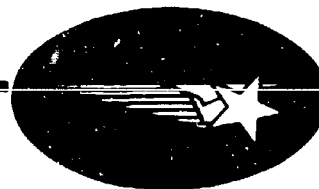


3-27-67-1 • VOL. 1 • MAY 1967

3-27-67-1 • VOL. 1



AD 654054

DASA 1971-1

# THERMAL RADIATION PHENOMENA

VOL. 1

THE EQUILIBRIUM THERMODYNAMIC  
PROPERTIES OF HIGH TEMPERATURE AIR

This document has been approved  
for public release and sale; its  
distribution is unlimited.

DASA 1971-1  
3-27-67-1 Vol 1  
May 1967

**THERMAL RADIATION PHENOMENA**

**The Equilibrium Thermodynamic  
Properties of High Temperature Air**

**by**

**Forrest R. Gilmore**

**Edited by**

**John L. Magee and Henry Aroeste**

Open Publication was approved by the Department of Defense on 3 April 1967

Distribution of this document is unlimited

## FOREWORD

"Thermal radiation" is electromagnetic radiation emitted by matter in a state of thermal excitation. The energy density of such radiation in an enclosure at constant temperature is given by the well known Planck formula. The importance of thermal radiation in physical problems increases as the temperature is raised; at moderate temperatures (say, thousands of degrees Kelvin) its role is primarily one of transmitting energy, whereas at high temperatures (say, millions of degrees Kelvin) the energy density of the radiation field itself becomes important as well. If thermal radiation must be considered explicitly in a problem, the radiative properties of the matter must be known. In the simplest order of approximation, it can be assumed that the matter is in thermodynamic equilibrium "locally" (a condition called local thermodynamic equilibrium, or LTE), and all of the necessary radiative properties can be defined, at least in principle. Of course whenever thermal radiation must be considered, the medium which contains it inevitably has pressure and density gradients and the treatment requires the use of hydrodynamics. Hydrodynamics with explicit consideration of thermal radiation is called "radiation hydrodynamics".

In the past twenty years or so, many radiation hydrodynamic problems involving air have been studied. In this work a great deal of effort has gone into calculations of the equilibrium properties of air. Both thermodynamic and radiative properties have been calculated. It has been generally believed that the basic theory is well enough understood that such calculations yield valid results, and the limited experimental checks which are possible seem to support this hypothesis. The advantage of having sets of tables which are entirely calculated is evident: the calculated quantities are self-consistent on the basis of some set of assumptions, and they can later be improved if calculational techniques are improved, or if better assumptions can be made.



The origin of this set of books was in the desire of a number of persons interested in the radiation hydrodynamics of air to have a good source of reliable information on basic air properties. A series of books dealing with both theoretical and practical aspects was envisaged. As the series materialized, it was thought appropriate to devote the first three volumes to the equilibrium properties of air. They are:

The Equilibrium Thermodynamic Properties of Air,  
by F. R. Gilmore

The Radiative Properties of Heated Air,  
by B. H. Armstrong and R. W. Nicholls

Tables of Radiative Properties of Air,  
by Lockheed Staff

The first volume contains a set of tables along with a detailed discussion of the basic models and techniques used for their computation. Because of the size of the related radiative tables and text, two volumes were considered necessary. The first contains the text, and the second the tables. It is hoped that these volumes will be widely useful, but because of the emphasis on very high temperatures it is clear that they will be most attractive to those concerned with nuclear weapons phenomenology, reentry vehicles, etc.

Our understanding of kinetic phenomena, long known to be important and at present in a state of rapid growth, is not as easy to assess as are equilibrium properties. Severe limitations had to be placed on choice of material. One volume is offered at this time:

Excitation and Non Equilibrium Phenomena in Air,  
by Landshoff, et al.

It provides material on the more important processes involved in the excitation of air, criteria for the validity of LTE and special radiative effects.

A discussion of radiation hydrodynamics was felt to be necessary and another volume was planned to deal with this topic:

Radiation Hydrodynamics of High Temperature Air,  
by Landshoff, Hillendahl, et al.

It is not ready for publication at this time. It will review the basic theory of radiation hydrodynamics and discuss the application to fireballs in the atmosphere.

The choice of material for these last two volumes was made with an eye to the needs of the principal users of the other three volumes.

Most of the work on which these volumes are based was supported by the United States Government through various agencies of the Defense Department and the Atomic Energy Commission. The actual preparation of the volumes was largely supported by the Defense Atomic Support Agency.

We are indebted to many authors and organizations for assistance and we gratefully acknowledge their cooperation. We are particularly grateful to the RAND Corporation for permission to use works of F. R. Gilmore and H. L. Brode and to the IBM Corporation for permission to use some of the work of B. H. Armstrong. Most of the other authors are employed by the Lockheed Missiles and Space Company, in some cases as consultants.

Finally we would like to acknowledge the key role of Dr. R. E. Meyerott of LMSC in all of this effort, from the initial conception to its realization. We are particularly grateful to him for his constant advice and encouragement.

Criticism and constructive suggestions are invited from all readers of these books. We understand that much remains to be done in this field, and we hope that the efforts represented by this work will be a stimulus to its development.

The Editors

J. L. Magee

H. Aroeste

## Preface

This volume is concerned with the thermodynamic properties of air as well as individual air constituents from  $1000^{\circ}\text{K}$  to  $10^7^{\circ}\text{K}$  for densities between 10 and  $10^{-7}$  times sea level density. It consists of text and tables which were both prepared by Dr. Forrest R. Gilmore. He is also the author of a somewhat smaller work (Gilmore, 1955) on the same topic which has received wide circulation.

The text describes the techniques, models and approximations used in calculation of the tables. It is not intended to be a general treatment of the theory of such calculations which is too well known to need restatement. The reader is expected to have some familiarity with both thermodynamics and statistical mechanics. Discussion of the approximations is detailed enough so that the accuracy can be readily assessed and improvements can be readily considered.

The tables can be accepted as an accurate summary of the thermodynamic properties of air and its constituents. They have been compared with other calculations (which differ in various approximations) and, where possible, with experiment. Of all inputs for calculations of hydrodynamics and radiation hydrodynamics, the equilibrium thermodynamic properties are by far the most reliable. It is unlikely that there will be a significant improvement of our knowledge in this area in the near future, nor is it needed, except perhaps at the highest density considered.

Information provided in the tables is much more widely useful than for air problems alone. It should be noted that most of the tables are devoted to the individual air constituents.

The air of this volume is a mixture of about 78%  $\text{N}_2$ , 21%  $\text{O}_2$ , 1% Ar, with a trace of  $\text{CO}_2$ . It is essentially the air (i.e., dry air) found in the

homosphere, or the atmosphere below 95 kilometers altitude. In the homosphere, mixing processes are rapid, and the composition remains essentially constant. The local thermodynamic equilibrium (LTE) approximation of radiation hydrodynamics is reasonable only in the homosphere. For convenience of the reader a discussion of properties of the atmosphere prepared by A. D. Anderson is included as Appendix A.

We would like to thank Dr. Forrest R. Gilmore for his splendid cooperation and the RAND Corporation for permission to include this work in our series on "Thermal Radiation." Thanks are also due Mr. A. D. Anderson for preparation of Appendix A.

J. L. Magee

H. Aroeste

## **Contents**

<b>Chapter 1.</b>	<b>The Equilibrium Thermodynamic Properties of High-Temperature Air: Discussion (F.R. Gilmore)</b>	<b>1</b>
1.1	Introduction	1
1.2	Air as a mixture of ideal gases in chemical equilibrium	2
1.3	Ideal gas properties for monatomic gases	10
1.4	Ideal gas properties for diatomic gases	21
1.5	Ideal gas properties for polyatomic gases	31
1.6	Effects of interparticle forces on the thermodynamic properties of air	32
1.7	Effects of Coulomb forces on the thermodynamic properties of air	40
1.8	Equilibrium calculations and results for air	44
<b>Chapter 2.</b>	<b>The Equilibrium Thermodynamic Properties of High-Temperature Air: Tables and Graphs (F.R. Gilmore)</b>	<b>59</b>
<b>Appendix A</b>	<b>Composition and Properties of the Atmosphere. (A.D. Anderson)</b>	<b>311</b>

## CHAPTER 1. THE EQUILIBRIUM THERMODYNAMIC PROPERTIES OF HIGH-TEMPERATURE AIR: DISCUSSION

### 1.1 Introduction

In order to calculate the behavior of nuclear fireballs and of hypersonic missiles and meteorites, one needs values for the thermodynamic properties of air over a wide range of temperatures and pressures or densities. At temperatures above about  $2000^{\circ}\text{K}$  there are great experimental difficulties in measuring these properties directly, while it is generally accepted that careful theoretical calculations can yield results of high accuracy. Consequently, in this chapter the methods and data available for the theoretical computation of such properties are outlined, and published results reviewed briefly. Some improvements over existing treatments are also indicated. Extensive tables based on these improved expressions are given in Chapter 2.

Throughout this chapter the assumption of local thermodynamic equilibrium (LTE) is made. In some situations of interest, such as fireballs or missile trails at very high altitudes, this assumption is not valid, and the results given in this chapter are not applicable. In such non-equilibrium situations the thermodynamic properties of air depend upon the energy deposition mechanisms and the subsequent atomic and molecular processes, as discussed in a companion volume of Thermal Radiation Phenomena, Excitation and Non-equilibrium Phenomena in Air.

## 1.2 Air as a mixture of ideal gases in chemical equilibrium

The thermodynamic properties of most gases at low and moderate densities can be approximated over a certain temperature range by a thermal equation of state of the form

$$pV = NRT \quad (1.2-1)$$

and a caloric equation of state of the form

$$E = NC_v T, \quad (1.2-2)$$

where  $p$  is the pressure,  $V$  the volume,  $N$  the number of moles,  $R$  the gas constant per mole,  $T$  the temperature,  $E$  the internal energy, and  $C_v$  the (constant) molal specific heat at constant volume. A gas which satisfies Eq. (1.2-1) and Eq. (1.2-2) is called a perfect gas. Many gases satisfy Eq. (1.2-1) over a fairly wide range of temperatures, but Eq. (1.2-2) only over a much narrower range. Consequently, the definition of a perfect gas is sometimes modified to include gases which obey Eq. (1.2-1) but not Eq. (1.2-2). However, to avoid ambiguity it seems preferable to follow thermochemical practice, and use the phrase ideal gas to denote a gas which is thermally perfect but has an internal energy varying arbitrarily with the temperature.

Ideal-gas thermodynamic properties for many pure elements and compounds have been calculated and tabulated by various workers. The most extensive and accurate set of such tables was recently issued by

a Joint Army-Navy-Air Force (JANAF) Thermochemical Panel in loose leaf form (JANAF Thermochemical Tables, 1960), with revisions issued periodically. These tables include values for most air molecules to 6000°K. Methods for making such calculations at still higher temperatures will be discussed in later sections of this chapter.

Air is a mixture of nitrogen and oxygen, with small amounts of argon, carbon dioxide, and rare gases, and a variable amount of water vapor. At low and moderate densities its thermodynamic properties may be obtained simply by adding the ideal-gas contributions from its components. This is straightforward at low temperatures, where the composition does not change. At high temperatures, however, dissociation and other chemical reactions cause the composition to vary with temperature and pressure. Because of this variation the product  $pV$  for the mixture is no longer proportional to  $T$ , even though each component is effectively ideal. Consequently, aerodynamicists often call air at high temperatures a "real gas," although thermochemists prefer to reserve this term for high densities where intermolecular forces cause deviations from ideal-gas behavior.

The first step in calculating the thermodynamic properties of high-temperature air is usually to calculate the equilibrium chemical composition. The basic condition for chemical equilibrium (Epstein, 1937) is that at a fixed temperature and pressure the amounts or concentrations of the various chemical species must be such as to minimize the Gibbs free energy of the mixture, subject to conservation of the chemical elements in the mixture. If the temperature is high enough to produce significant ionization, electrons and ions must be included among the species, and charge must also be conserved.



The Gibbs free energy of an ideal-gas mixture is given by

$$F_{\text{tot}} = \sum_i N_i (F_i^{\circ} + RT \ln p_i) , \quad (1.2-3)$$

where  $N_i$  is the number of moles of the  $i$ -th species,  $F_i^{\circ}$  is the ideal-gas molal free energy of this species (at the temperature  $T$  and one atmosphere pressure), and  $p_i$  is its partial pressure (in atmospheres). White, Johnson, and Dantzig (1958) have developed numerical methods for minimizing Eq. (1.2-3) while keeping the temperature and the total pressure fixed and conserving mass. Their methods are convenient for calculating equilibrium compositions at specified temperatures and pressures. For fireball applications it is preferable to make computations at specified temperatures and volumes (or densities), because the air density within a fireball varies by two or three orders of magnitude at most, while the pressure variation can be several more orders of magnitude. A convenient procedure for such computations can be based on the thermodynamic principle of minimizing the Helmholtz free energy (or work function)

$$A_{\text{tot}} = F_{\text{tot}} - pV = \sum_i N_i [F_i^{\circ} - RT + RT \ln (N_i RT/V)] , \quad (1.2-4)$$

at a fixed temperature and volume (Epstein, 1937). Since Eq. (1.2-4) has nearly the same form as Eq. (1.2-3), the procedures of White, Johnson and Dantzig (1958) can be used with only minor modification.

For systems involving a limited number of reactions, or for more complex systems if a high-speed computer is not available, a computation

method based on "equilibrium constants" may be more convenient. To derive the necessary equations from the free-energy minimization principle, consider the effect of small changes  $\delta N_i$  in the amounts of the chemical species, while the temperature and (total) pressure are held fixed. By the use of Eq. (1.2-3) and the relation  $p_i = p N_i / \sum_1 N_i$ , the variation in free energy at constant  $p$  may be expressed as

$$\delta F_{\text{tot}} = \sum (F_i^{\circ} + RT \ln p_i) \delta N_i + \sum_1 N_i RT \delta (\ln N_i) - \sum_1 N_i RT \delta (\ln \sum_1 N_i). \quad (1.2-5)$$

Since  $\delta \ln x = \delta x / x$ , the last two terms on the right hand side of Eq. (1.2-5) cancel and the final result becomes

$$\delta F_{\text{tot}} = \sum_1 (F_i^{\circ} + RT \ln p_i) \delta N_i. \quad (1.2-6)$$

In equilibrium the free energy has a minimum, so  $\delta F_{\text{tot}} = 0$  and from Eq. (1.2-6)

$$\sum_1 \delta N_i \ln p_i = - \sum_1 \delta N_i (F_i^{\circ} / RT) \quad (1.2-7)$$

for all sets of  $\delta N_i$  which satisfy the mass-balance constraints. One way of satisfying these constraints is to consider possible chemical reactions, such as



A composition variation due only to this reaction has  $\delta N_{XY} = -\delta N_X = -\delta N_Y$  with all other  $\delta N_i$  vanishing. Eq. (1.2-7) then gives

$$\ln p_{XY} - \ln p_X - \ln p_Y = - \frac{F_{XY}^{\circ} - F_X^{\circ} - F_Y^{\circ}}{RT} \quad (1.2-9)$$

Taking the exponential of this equation, one obtains

$$\frac{p_{XY}}{p_X p_Y} = \exp \left[ - \frac{F_{XY}^{\circ} - F_X^{\circ} - F_Y^{\circ}}{RT} \right]. \quad (1.2-10)$$

The right hand side of Eq. (1.2-10) is independent of the composition and pressure of the mixture (although it does vary with temperature); it is conventionally called the equilibrium constant,  $K_p$ , of reaction Eq. (1.2-8). With the help of the ideal-gas relation,  $p_i = N_i RT/V = \bar{N}_i RT$ , where  $\bar{N}_i$  is the concentration (moles per unit volume) of the species  $i$ , Eq. (1.2-10) may be transformed to

$$\frac{\bar{N}_{XY}}{\bar{N}_X \bar{N}_Y} = RT \exp \left[ - \frac{F_{XY}^{\circ} - F_X^{\circ} - F_Y^{\circ}}{RT} \right]. \quad (1.2-11)$$

(In Eq. (1.2-11) the  $F_i^{\circ}$  are conventionally evaluated at 1 atmosphere pressure; hence, the units of  $RT$  must be atm-volume/mole.) The right hand side of Eq. (1.2-11) may be called the concentration equilibrium constant  $K_n$ , for reaction Eq. (1.2-8).

If there are  $I$  chemical species present in a reacting mixture and  $J$  mass-balance conditions to be satisfied (one for each element present, plus one for charge neutrality if ions are present), it turns out that  $I - J$  independent equilibrium equations of the form Eq. (1.2-10) or Eq. (1.2-11)

can be found, and thus there are just enough equations to determine the partial pressures or concentrations uniquely. The set of equations used, however, is not unique, since, for example, the sum or difference of two reactions is also a permissible reaction; its equilibrium constant is just the product or quotient of the constants for the two reactions. Any convenient complete set of equations can be used to get the equilibrium composition.

Unless only two or three reactions are involved, a closed-form solution to the equilibrium equations is usually not obtainable, and numerical iteration schemes must be used. An important exception occurs however, when only atoms, atomic ions, and electrons are involved. The equilibrium ionization equations for each element  $X$  can be written

$$N_{X^+} = K_{X^+} N_X / N_e, \quad N_{X^{++}} = K_{X^{++}} N_X / N_e^2, \quad N_{X^{+++}} = K_{X^{+++}} N_X / N_e^3, \quad \dots, \quad (1.2-12)$$

where  $N_e$  is the electron concentration.\* The sum of these concentrations, plus  $N_X$ , is the total concentration of the element  $X$ ,  $N_{\text{tot } X}$ , which is usually specified. The summed equations can be readily solved for  $N_X$ :

$$N_X = \frac{N_{\text{tot. } X}}{1 + K_{X^+} / N_e + K_{X^{++}} / N_e^2 + \dots} \quad (1.2-13)$$

\* If the negative ion  $X^-$  is stable, an additional equation for its concentration must be included in Eq. (1.2-12), and corresponding additional terms added to subsequent equations, but this does not complicate the analysis significantly.

If the elements  $X, Y, \dots$  are present, the charge-balance relation is

$$N_e = N_{X+} + 2N_{X++} + 3N_{X+++} + \dots + N_{Y+} + 2N_{Y++} + 3N_{Y+++} + \dots \quad (1.2-14)$$

With the help of Eqs. (1.2-12), (1.2-13), and similar relations for  $Y$ , etc., Eq. (1.2-14) can be written

$$N_e = \frac{N_{\text{tot.}X}(K_{X+}N_e + 2K_{X++}N_e^2 + \dots)}{1 + K_{X+}N_e + K_{X++}N_e^2 + \dots} + \frac{N_{\text{tot.}Y}(K_{Y+}N_e + 2K_{Y++}N_e^2 + \dots)}{1 + K_{Y+}N_e + K_{Y++}N_e^2 + \dots} + \dots \quad (1.2-15)$$

In a specified-density problem the total concentration of each element is known, and Eq. (1.2-15) can in principle be solved for  $N_e$ , although analytic solutions are possible only when the number of different ions present is small. However, if the elemental composition (hence, the ratios  $N_{\text{tot.}Y}/N_{\text{tot.}X}$ , etc.) and the electron concentration  $N_e$  are taken as independent variables, Eq. (1.2-15) can be solved directly for  $N_{\text{tot.}X}$ , and then the other concentrations can be obtained from Eq. (1.2-12), etc., all without iteration.\*

Although a solution of Eq. (1.2-15) at a specified density (i.e., specified values of  $N_{\text{tot.}X}$ ,  $N_{\text{tot.}Y}$ , etc.) usually requires an iteration process, it is a particularly simple one, involving only the variable  $N_e$ . A numerical study by the writer shows that a scheme using the total atom concentration as the first approximation to  $N_e$ , and obtaining successively better values

---

\* This fact has been discovered, apparently independently, by a number of different workers. The earliest publication known to the writer is that of Hilsenrath, Green, and Beckett (1959).

by substituting the previous value in the right hand side of Eq. (1.2-15), converges quite rapidly when the second approximate  $N_{\bullet}$  is larger than about half the atom concentration. For smaller  $N_{\bullet}$  values, rapid convergence can be obtained by using for each new approximation the geometric mean between the previous approximation and the value obtained from Eq. (1.2-15).

Once the equilibrium composition of a reacting gas mixture such as high-temperature air is obtained by the free-energy-minimization or equilibrium-constant methods described above, the basic thermodynamic properties may be obtained simply by adding the ideal-gas contributions from the various constituents. The ideal-gas entropies and free energies are conventionally tabulated for 1 atmosphere pressure, and must be corrected to the actual partial pressure of each species, as earlier indicated for the free energy (see Eq. (1.2-3)).

Calculations for "differential" thermodynamic functions, such as the specific heat, are less straightforward. A specific heat computed by averaging the specific heats of the component species, weighted according to their equilibrium concentrations at a given temperature and density, is a "frozen composition" specific heat, useful only in situations where the temperature is varied so rapidly that chemical reactions do not have time to take place. In the usual true-equilibrium situation, however, the variation of composition with temperature gives an additional contribution to the specific heat. Hochstim (1962) has presented rather lengthy equations for the specific heat and related quantities in terms of the equilibrium constants and their temperature derivatives, and shown how

they can be solved for air using a high-speed computer. In most cases, however, it is probably simpler to calculate the energy at two or three closely-spaced points and obtain the specific heat by numerical differentiation. Moreover, in many fireball calculations the energy and pressure of air are approximated by analytic functions of temperature and density. Differentiation of these functions gives approximate values for the specific heat, velocity of sound, etc., rather simply.

The equilibrium compositions obtained in the course of calculating thermodynamic properties are also useful in determining radiation properties (see Volume 2) and transport properties (viscosity, electrical conductivity, etc.) of air. For these purposes it is often more convenient to express species concentrations in terms of molecules (atoms, ions) per unit volume. Since thermochemical tables are usually based on the gram mole, the equations in this chapter are given in molal form, but they are equally valid if concentrations are expressed in molecules (or particles) per unit volume, while volumes, energies, etc., are taken per molecule instead of per mole and the gas constant per mole,  $R$ , is replaced by the gas constant per molecule,  $k$  (Boltzmann's constant).

### 1.3 Ideal-gas properties for monatomic gases

As will be shown below, the thermodynamic properties of monatomic gases depend in part on the quantum-mechanical properties of their constituent atoms. It is beyond the scope of this chapter to explain the quantum mechanics of atomic structure (for a good introduction, see

Herzberg, 1944). However, in the next few paragraphs, enough of the terminology will be explained to permit the reader to use existing energy-level tables to calculate thermodynamic properties.

An atom or atomic ion may exist in many different states with different energies, corresponding to different arrangements of the orbital electrons. According to quantum-mechanical principles for light atoms (Russell-Saunders coupling, Herzberg, 1944), the states are grouped in terms, where for each term the total orbital angular momentum (in atomic units) of the electrons must be an integer. The terms are designated, for historical reasons, by the letters S, P, D, F, G, H, ..., corresponding to total orbital angular momenta, L, equal to 0, 1, 2, 3, 4, 5, ..., respectively. In addition, each electron possesses a spin (intrinsic angular momentum) of  $1/2$ , and these spins add algebraically to give a total spin S. The quantity  $2S + 1$  is called the multiplicity of the term; it is conventionally written as a superscript. Thus a term with  $L = 2$  and  $S = 3/2$  is denoted by  $^4D$ . A given atom or ion may have many terms of the same type, with the same L and S values, but differing in the arrangement of the individual electrons, and thus in the energy.

A term having  $S \leq L$  is composed of  $2S + 1$  levels, having total angular momenta  $J = L + S, L + S - 1, L + S - 2, \dots, L - S$ , respectively, all with energies fairly close to each other. (If  $L \leq S$ , the quantities L and S should be interchanged in the preceding statement). Thus, a  $^4D$  state is composed of four levels designated by subscripting their J values:  $^4D_{7/2}, ^4D_{5/2}, ^4D_{3/2}, ^4D_{1/2}$ . By placing the atom in a magnetic field, each of these levels can be split further, into  $2J + 1$  individual



sublevels. Quantum theory shows that there are just this many distinct "quantum states" in such an electronic level; in the absence of a magnetic or electric field their energies are the same, so that they can be treated as a single level with a "degeneracy" or statistical weight of  $2J + 1$ . Often, the splitting of an  $L, S$  state into levels with different  $J$  values can also be ignored, and it can be treated as a single level with a statistical weight of  $(2L + 1)(2S + 1)$ . Thus, a  ${}^4D$  state has a statistical weight of 20; its four levels ( ${}^4D_{7/2}$ ,  ${}^4D_{5/2}$ ,  ${}^4D_{3/2}$ ,  ${}^4D_{1/2}$ ) have statistical weights of 8, 6, 4, and 2, respectively.

Except for one-electron atoms and ions, accurate calculations of energy levels are difficult, while very accurate measurements by spectrography are usually relatively simple. Since spectroscopists measure wavelengths, which by Planck's law are inversely proportional to the energy level differences, they conventionally present energy levels in units of  $\text{cm}^{-1}$ . To convert to true energy units, these must be multiplied by  $hc$ , where  $h$  is Planck's constant and  $c$  is the velocity of light.

Moore (1949) has collected together the best experimental energy-level values for the light elements and ions; her tables are complete enough for many practical purposes. If necessary, Moore's values can be tested for completeness by comparison with the tables of predicted terms given in the front of the same volume, and missing values estimated by using various semiempirical methods (isoelectronic extrapolation, quantum defects, screening constants (Herzberg, 1944; Edlen, 1964)). For the highly ionized species, for which experimental data are incomplete, Edlen (1964) gives a number of useful extrapolation formulas and tables.

Fig. 1.1 depicts, as an example, the energy levels of the nitrogen atom. Since, there are many terms with the same  $L$  and  $S$  values, the terms are also marked with the quantum numbers of the individual electrons. Thus,  $2s2p^4$  indicates one electron with principal quantum number  $n = 2$  and orbital angular momentum  $l = 0$ , and four electrons with  $n = 2$  and  $l = 1$ . Although not marked, all of the states shown have two inner, tightly bound electrons,  $1s^2$ ; states without these electrons lie so high in energy that they can be completely ignored for present purposes.

According to statistical mechanics (Mayer and Mayer, 1940), in an ideal gas in equilibrium, the fraction of an atomic or ionic species which is in a particular electronic state or level  $j$  is

$$N_j/N = (g_j/Q) \exp (-hcE'_j/kT) , \quad (1.3-1)$$

where  $g_j$  is the statistical weight of the level,  $E'_j$  is its energy (in  $\text{cm}^{-1}$ ), and  $Q$  is a proportionality constant called the partition function. The fraction  $N_j/N$  is also called the "fractional population" or "occupation number." When Eq. (1.3-1) is summed over all  $j$  values, the left-hand side reduces to unity and the equation can be solved for the partition function:

$$Q = \sum_j g_j \exp (-c_2 E'_j/T) , \quad (1.3-2)$$

where  $c_2$  is known as the second radiation constant,

$$c_2 = hc/k = 1.43879 \text{ cm}^\circ\text{K} \quad (1.3-3)$$

The values quoted in this chapter for the pertinent physical constants are those recently recommended by the National Academy of Sciences - National Research Council (1964); they differ slightly from those used in previous work.

The electronic-energy contribution of the atoms in state  $j$  to the internal energy of the gas is  $N_j Q hcE'_j$ , where  $Q$  is the number of atoms per mole (Avogadro's number). Since  $Q = R/k$ , this contribution can also be written  $N_j Rc_2 E'_j$ . The ideal-gas internal energy per mole can then be obtained by using Eq. (1.3-1) to evaluate  $N_j$ , summing the contributions over  $j$ , and adding  $(3/2)RT$  for the contribution from the translational motion of the atoms. The result may be written in dimensionless form:

$$\frac{E^o - E_0^o}{RT} = \frac{3}{2} + \frac{1}{QT} \sum_j c_2 E'_j \exp(-c_2 E'_j / T), \quad (1.3-4)$$

where the superscript  $o$  indicates the ideal-gas state, the subscript  $0$  indicates  $0^\circ\text{K}$ , and

$$R = 8.3143 \times 10^7 \text{ erg}/^\circ\text{K-mole} = 1.98717 \text{ cal}/^\circ\text{K-mole}. \quad (1.3-5)$$

$E_0^0$  in Eq. (1.3-4) represents the internal energy of the ideal gas at  $0^\circ\text{K}$ ; its numerical value is somewhat arbitrary, since in thermodynamics only energy differences can be measured. However, in reacting gases, consistent choices must be made, so that the differences in  $E_0^0$  values between the reactants and the products gives the correct reaction energy (at absolute zero). For example, if  $E_0^0$  is taken to be zero for atomic N, the corresponding quantity for  $\text{N}^+$  must equal the ionization energy of N, while that for  $\text{N}_2$  must be the negative of the dissociation energy. In thermochemistry it is conventional to choose  $E_0^0 = 0$  for the elements in the phases that are stable at room temperature and pressure. For air (including carbon dioxide) these are gaseous  $\text{N}_2$ ,  $\text{O}_2$ , and Ar and crystalline graphite. The use of graphite as a reference material has the disadvantage that it makes the internal energy of gaseous  $\text{CO}_2$  negative, and this causes the calculated energies for air near room temperature to deviate appreciably from direct proportionality to the temperature. To prevent this behavior,  $E_0^0$  for gaseous  $\text{CO}_2$  (as well as gaseous  $\text{N}_2$ ,  $\text{O}_2$ , and Ar) has been set equal to zero in the present work.

The corresponding values of  $E_0^0$  for the atomic species of present interest are given in the first table of the second chapter, together with the dissociation and ionization energies from which they were derived, and the corresponding references. An effort was made to obtain the best values presently available, since results of thermodynamic calculations are usually more sensitive to inaccuracies in these values than to any other inaccuracies.

The ideal-gas entropy (at one atmosphere pressure) can be obtained, except for a constant term, from the thermodynamic relation  $S = \int dH/T$  ( $p$  constant), where  $H = E + RT$  and  $E$  is given by Eq. (1.3-4). The result can be written

$$S^{\circ}/R = (E^{\circ} - E_0^{\circ})/RT + \ln Q + \frac{5}{2} \ln T + C, \quad (1.3-6)$$

where statistical mechanics (Mayer and Mayer, 1940) shows that the integration constant is

$$C = 1 + \ln(k/p^{\circ}) + \frac{3}{2} \ln(2\pi M k/C h^2) = \frac{3}{2} \ln M - 2.66496, \quad (1.3-7)$$

with  $p^{\circ} = 1$  atmosphere and  $M$  the atomic weight. Other ideal-gas thermodynamic properties can be obtained from Eq. (1.3-4) and Eq. (1.3-6) using well-known thermodynamic identities. For example, the dimensionless Gibbs free energy is given by

$$-\frac{F^{\circ} - E_0^{\circ}}{RT} = \frac{S^{\circ}}{R} - \frac{E^{\circ} - E_0^{\circ}}{RT} - 1 = \ln Q + \frac{5}{2} \ln T + \frac{3}{2} \ln M - 3.66496. \quad (1.3-8)$$

Substitution of this expression in Eq. (1.2-11) gives an equation for the equilibrium constant in terms of the partition functions of the reactants:

$$\frac{N_{AB}}{N_A N_B} = Q \left( \frac{Q_{AB}^2 M_{AB}}{2\pi k T M_A M_B} \right)^{3/2} \frac{Q_{AB}}{Q_A Q_B} \exp \left[ - \frac{E_0^{\circ}(AB) - E_0^{\circ}(A) - E_0^{\circ}(B)}{RT} \right]. \quad (1.3-9)$$

When  $A$  represents a positive ion,  $B$  an electron (with  $Q_B = 2$ ), and  $AB$  a neutral atom, Eq. (1.3-9) yields the familiar Saha equation for equilibrium ionization.

In calculating ideal-gas functions by the above equations, however, there is a basic difficulty not mentioned in elementary texts. An isolated atom or positive ion (in an unlimited volume) actually has an infinite number of stable electronic states with energies  $E_j$  less than its ionization energy, and thus the sums in Eq. (1.3-2) and Eq. (1.3-4) diverge. However, at temperatures up to several thousand degrees the series are semi-convergent in the sense that essentially the same answer is obtained by taking the first ten or the first ten thousand terms. The omission of the infinite "tail" of the series, which contains terms corresponding to electrons in highly-excited levels, is justified because in actual situations no atom can occupy an unlimited volume, since it is limited at least to the volume of the system, and generally, in systems containing many atoms, to a much smaller volume, comparable to the mean volume per atom (see Section 1.7).

At somewhat higher temperatures the difficulty is less trivial, because there may be no point at which the terms in the sum become small, and thus the answer may depend significantly upon where the series is broken off. This is illustrated in Fig. 1.2, which shows the percentage increase in internal energy and free energy as the cutoff point is raised from an electron quantum number of  $n = 4$  to  $n = 8$ . Various workers have suggested simple cutoffs which depend upon the atom density, the electron density, or the temperature. However, none of these simple

one-parameter relations can be completely correct, because the high electronic levels are affected both by close-in neutral particles and, to a greater extent, by close-in charged particles, while the temperature influences how often these particles come close-in. The true cutoff is thus a function of the composition, density, and temperature, so that if the sums in Eqs. (1.3-2) and (1.3-4) are sensitive to the cutoff the "ideal-gas" functions also depend upon the composition and density as well as temperature, which greatly complicates thermodynamic calculations. Moreover, the higher bound levels below the cutoff may be perturbed sufficiently to further affect the thermodynamic properties.

As shown by Fig. 1.2, at successively higher stages of ionization an atom's properties remain independent of the cutoff to successively higher temperatures. In air below standard (sea level) density, as the temperature is raised to the point where the cutoff for any particular ion becomes important the concentration of that ion becomes so small (due to further ionization) that the choice of cutoff has little effect on the thermodynamic properties of the equilibrium mixture. Unfortunately, this simplification does not hold for the highest air densities of present interest (up to 10 times the standard density, as produced by a strong shock wave at low altitudes). Even at such densities, however, electronic states with  $n \leq 4$  should be little affected by neighboring atoms, since the electronic orbits of such states lie well within the mean interatomic or interionic distance. Thus, thermodynamic functions calculated by summing up to  $n = 4$  represent lower limits to the true values. In addition, they usually represent useful approximations to the actual

values, since at high densities the correct cutoff is not much greater than 4 (see Section 1.7), while at low densities the equilibrium properties are relatively insensitive to the cutoff, as already pointed out.

If better, variable-cutoff thermodynamic properties are required they may be obtained by adding the contributions from states between  $n = 5$  and the cutoff  $n_c$ . For light atoms and ions, the most important of such states are those having only one electron with  $n > 4$ , such states with one electron outside a "core" are quite hydrogen-like, with a statistical weight equal to  $2n^2$  times that of the core (with the outer electron removed), and an energy just  $Ry (Z + 1)^2/n^2$  less than the energy of the core, where  $Ry$  is the Rydberg ( $109,737 \text{ cm}^{-1} = 13.605 \text{ eV}$ ), and  $Z$  is the charge of the atom or ion. The partition-function summation, Eq. (1.3-2), over these states can then be factored into a sum over the states of the outer electron and a sum over the states of the core. The final result is

$$Q(X) = Q_{n \leq 4}(X) + Q_{n \leq 4}(X^+) \exp\left(-\frac{I(X)}{kT}\right) \sum_{n=5}^{n_c} 2n^2 \exp\left(\frac{Ry (Z+1)^2}{n^2 kT}\right) \quad (1.3-10)$$

where  $Q_{n \leq 4}(X^+)$  is the partition function for the next higher ion and  $I(X)$  is the  $X \rightarrow X^+$  ionization energy. Since the cutoff  $n_c$  depends upon temperature, density, and somewhat on composition (see Section 1.7), it is more convenient to calculate the correction term on the right hand side of Eq. (1.3-10) during the course of an equilibrium ionization calculation than to tabulate the "true" ideal-gas thermodynamic properties of each species as functions of two or three variables.



Accordingly, ideal gas functions for the atoms and ions of C, N, O, and Ar have been calculated for temperatures of present interest using a fixed cutoff just above  $n = 4$ . Extensive numerical results are presented in Chapter 2. Tables showing the energy-level data used, and the fractional population of each electronic state versus temperature are also included. The thermodynamic results have been compared with results of several previous workers (JANAF Thermochemical Tables, 1960; Gilmore, 1955; Woolley, 1957; Kilsch, Gilmer, and Gilles, 1957; Green, Poland, and Margrave, 1960; Yungman et al., 1961; Martinez, 1961; Gurvich et al., 1962; McBride et al., 1963; Hilsenrath, Messina, and Evans, 1964). Up to 10,000°K, almost all the results agree to within 0.03 per cent. Moreover, the small differences are due primarily to use of different values for the gas constant  $R$ ; if this is corrected for, the deviations are generally reduced to less than 0.01 per cent. An exception is the table for N by Hilsenrath, Messina, and Evans (1964), which gives values deviating from other work by up to 2 per cent (their values for the other air atoms and ions show no such deviation).

Only a few tables extending above 10,000°K have been published previously, and these show increasing variations in the results for the neutral atoms, depending upon the electronic cutoff used by the different investigators. (Variations for the ions appear only at considerably higher temperatures, as shown by Fig. 1.2.) The earlier work by the writer (Gilmore, 1955) up to 24,000°K used a cutoff around  $n = 5$  but omitted some states. Up to 12,000°K those results agree very well with the present results, but differ by up to 6 per cent for the neutral atoms at 24,000°K. The values of Woolley (1957) to 4,000,000°K and the extensive Russian tables (Yungman et al., 1961; Gurvich et al., 1962) to 20,000°K also show deviations above 10,000°K. Woolley (1957) used a somewhat different type of cutoff that excludes many

states included in the present work (planning to include them in subsequent equilibrium calculations). Hence, his values for the enthalpy, entropy, and negative free energy are generally lower than the present values; for the neutral atoms the difference is a few per cent or less at 20,000°K. On the other hand, the Russian values are generally higher because they used cutoffs at  $n = 11 - 13$ , based on restricting the electrons to the mean volume per atom at densities corresponding to a pressure of one atmosphere. At 20,000°K their enthalpy values for the neutral atoms are almost a factor of two higher than the present values, although their entropies and free energies are only a few per cent higher. Whether such differences are significant in equilibrium thermodynamic calculations depends upon the density under consideration and also upon whether separate allowance for the highly excited states is made in the equilibrium computation, as already discussed (see also Section 1.7).

#### 1.4 Ideal-gas properties for diatomic gases

The relations Eqs. (1.3-4) and (1.3-6) for the energy and entropy of a monatomic gas apply equally well to a molecular gas, provided that the summations are extended over all the molecular energy levels, which can differ not only in electronic energy but also in rotational and vibrational energy. Because of these additional degrees of freedom, the individual levels of a molecule are so numerous that it is rather impractical to tabulate all of them. Fortunately, however, for each degree of electronic excitation the rotational and vibrational levels are usually quite regular and can be represented by simple formulas, only the coefficients of which

need to be tabulated. Moreover, using these formulas, the terms of the series in Eqs. (1.3-2), (1.3-4) and (1.3-6) can often be summed algebraically with reasonable accuracy, at least in some temperature ranges.

The energy levels of molecules can be grouped into electronic states, each of which is characterized (in part) by the total spin  $S$  of the electrons. Just as for atoms, the multiplicity  $2S + 1$ , is written as a superscript on the left of the state symbol. Unlike the atoms, however, diatomic molecules have an internuclear axis, and the second important quantum number is not the total orbital angular momentum,  $L$ , of the electrons, but the component,  $\Lambda$ , of this momentum in the axial direction. In analogy with the Roman-letter designations of atomic terms, diatomic states are designated by the Greek letters  $\Sigma$ ,  $\Pi$ ,  $\Delta$ ,  $\Phi$ , ..., corresponding to  $\Lambda = 0, 1, 2, 3, \dots$ . Because in diatomic molecules terms of a given  $L$  are separated into states of different  $\Lambda$ , the statistical weights of these states are generally less than those of the corresponding atomic terms; specifically, the weights are  $2S + 1$  for  $\Sigma$  states and  $2(2S + 1)$  for  $\Pi$ ,  $\Delta$ ,  $\Phi$ , ..., states. States with  $S > 0$  and  $\Lambda > 0$  split into  $2S + 1$  substates, designated by writing the vector sum of  $\Lambda$  and the axial component of  $S$  as a subscript. However, this splitting can often be ignored, since it is usually small and often associated only with higher excited states. Other subscripts and superscripts are sometimes added to the state symbol to indicate the electronic symmetry, but this does not affect the present considerations.

Since a diatomic molecule may have more than one state with the same  $S$  and  $\Lambda$  values, and also since there may be a considerable period between the experimental discovery of a state and the determination of its type, the states are also labelled somewhat arbitrarily by Roman letters, with  $X$  designating the ground state, and  $A, B, C, \dots$  the successively higher (or earlier discovered) states of the same multiplicity as the ground state, while  $a, b, c, \dots$  designate states of a different multiplicity. (Exceptions are the  $N_2$  and  $C_2$  molecules, where the capital and lower case letters are reversed, due to early misidentification of the ground state.)

The electronic energy of a diatomic molecule depends not only upon the electronic state but also upon the interatomic (or, more accurately, internuclear) distances. Curves showing this variation for  $N_2$  and  $N_2^+$  are presented in Fig. 1.3. At large internuclear distances the energy must be that of two individual atoms. At distances approaching zero the energy must approach infinity because of the strong Coulomb (electrostatic) repulsion between the two nuclei. At intermediate distances the curve must have a minimum if the molecular state is to be stable. The two nuclei will tend to approach this minimum-energy distance, but may vibrate about this point. Since the vibrational motion of the nuclei is much slower than the orbital motions of the lighter electrons, the electrons will keep adjusted to the instantaneous position of the nuclei. Thus, the electronic energy will follow the same curve regardless of the amplitude of vibration, and such a curve forms an effective potential for molecular vibration.

The lower portion of an attractive potential curve (see Fig. 1.3) can often be approximated by a parabola. Quantum theory (Herzberg, 1950) shows that the vibrational energy in a parabolic potential equals  $w(v + 1/2)$ , where  $w$  is a constant which depends inversely upon the width of the parabola,  $v$  is the vibrational quantum number, which can take on the values 0, 1, 2, ..., and the zero of energy is measured from the bottom of the parabola. Actual potential curves, however, diverge more and more from a parabola at higher energies; therefore the vibrational energy levels, instead of being evenly spaced as in the above formula, fall closer and closer together as the dissociation limit is approached. It is conventional to fit these levels by the formula

$$G(v) = w_e(v + 1/2) - w_e x_e(v + 1/2)^2 + w_e y_e(v + 1/2)^2 + \dots, \quad (1.4-1)$$

where  $w_e$ ,  $w_e x_e$ ,  $w_e y_e$ , etc., are constants determined spectroscopically, and the subscripted  $e$  indicates that this is an expansion about the equilibrium point (potential curve minimum). The short numbered lines on the potential curves of Fig. 1.3 indicate the observed vibrational energy levels of these molecules.

Besides vibrating, a molecule can also rotate. The simplest approximation is that of a "rigid rotator," whose quantum-mechanical energy levels (Herzberg, 1950) are given by  $BJ(J+1)$ , where  $B$  is a constant inversely proportional to the square of the internuclear distance, and the rotational quantum number  $J$  equals 0, 1, 2, ... Since actual molecules are not rigid, but stretch as they rotate so that the effective value of  $B$

decreases with increasing  $J$ , a negative correction term proportional to  $J^2(J+1)^2$  is conventionally added to the energy expression. Moreover, if the molecule is also vibrating, this affects the mean internuclear distance and gives a  $B$  value which depends somewhat on the vibrational quantum number.

By adding the contributions of electronic, vibrational, and rotational energy one obtains the following general formula for the molecular energy levels (term values):

$$\begin{aligned} \tilde{G}(v, J) = & \tilde{G}_e^* + \omega_e(v+1/2) - \omega_e x_e(v+1/2)^2 + \omega_e y_e(v+1/2)^3 \\ & + \dots + B_v J(J+1) - D_v J^2(J+1)^2 + H_v J^3(J+1)^3 + \dots, \end{aligned} \quad (1.4-2)$$

where

$$B_v = B_e - \alpha_e(v+1/2) + \gamma_e(v+1/2)^2 + \dots,$$

$$D_v = D_e + \beta_e(v+1/2) + \dots,$$

$$H_v = H_e + \delta_e(v+1/2) + \dots,$$

and  $\tilde{G}_e^*$  is the electronic energy at the equilibrium distance, taking the zero of energy to be the lowest level ( $v = 0, J = 0$ ) of the ground state. (The asterisk is added to distinguish this quantity from the conventional  $\tilde{G}_e$ , the energy above the potential minimum of the ground state.) In Eq. (1.4-2) some generally-negligible terms due to the interaction of the electronic and

rotational angular momenta have been omitted.

The statistical weight of each level is just the electronic statistical weight already discussed, multiplied by  $2J + 1$  for most molecules. However, if the molecule is homonuclear (like  $N_2$ ,  $N_2^+$ , etc.) the  $2J + 1$  is replaced by a rapidly-oscillating function of  $J$ , which for present purposes can be approximated by its mean value,  $(2J + 1)/2$ .

Since each electronic state has only a finite number of bound rotational-vibrational levels,\* the summations required for thermodynamic calculations can be carried out without any further convergence difficulties. However, at temperatures of a few thousand degrees, many hundreds of terms make significant contributions to the sums, so that hand computations become lengthy. For this reason, Mayer and Mayer (1940) have worked out approximate algebraic formulas for these sums, based on replacing the summation over rotational levels by an integration, and neglecting or approximating the higher correction terms in the energy-level formulas. However, some of these approximations become poor at very high temperatures. Moreover, with modern high-speed computers it is virtually as easy to perform the summation directly.

At temperatures above  $5000^\circ K$  or  $6000^\circ K$ , vibration-rotation energy levels of the lower electronic states near their dissociation limits can make significant contributions to the thermodynamic properties. Unfortunately, spectroscopic measurements on such levels have not been made for most electronic states of interest. For the few states for which they are available, it is found that a large number of terms must be included in Eq. (1.4-2) in order to fit the data. This indicates that the usual measurements on only the lower levels of an electronic state cannot be safely

---

\* Neglecting a few highly-excited states which dissociate to positive plus negative atomic ions.

extrapolated to get the very high levels. However, these levels are determined by the high portions of the corresponding potential curve. It is often possible to determine this curve with some confidence, by use of Rydberg-Klein and valence-bond calculations (Vanderslice, Mason, and Lippincott, 1959; Gilmore, 1965). The energy levels corresponding to this curve can then be calculated quantum-mechanically.

For present purposes, however, it is possible to bypass this last step, and calculate the contributions of the high levels to the thermodynamic properties directly from the potential curve. At temperatures where these levels contribute significantly, their spacing is small compared to  $kT$ , so that the formulas of classical statistical mechanics can be used. These formulas show that the partition function for structureless particles of mass  $m$  with total energies between  $E_1$  and  $E_2$ , in a volume  $dV$  where the potential is  $U$ , is given by (Mayer and Mayer, 1940):

$$\frac{2\pi(2m)^{3/2}dV}{h^3} \int_{E_1}^{E_2} (E-U)^{1/2} \exp(-E/kT) dE \quad (1.4-3)$$

$$= \frac{2\pi(2mkT)^{3/2}dV}{h^3} e^{-U/kT} \left[ \frac{\sqrt{\pi}}{2} \operatorname{erf} x^{1/2} - x^{1/2} e^{-x} \right]_{(E_1-U)/kT}^{(E_2-U)/kT},$$

where  $\operatorname{erf}$  is the error function. The partition function contribution from diatomic energy levels between  $E_1$  and the dissociation energy  $D$  can be obtained by multiplying the above expression by the electronic statistical weight  $g_e$ , letting  $m$  be the reduced mass,  $M_1 M_2 / (M_1 + M_2) Q$ ,



where  $M_1$  and  $M_2$  are the atomic weights of the two atoms, replacing  $dV$  by  $4\pi r^2 dr$  where  $r$  is the internuclear distance, and integrating over  $r$ . The result is

$$Q(E_1 \text{ to } D) = \frac{8\pi^2 (2mkT)^{3/2} g}{h^3} \left[ \int_{r_0}^{\infty} f_D(r) r^2 dr - \int_{r_1}^{r_2} f_1(r) r^2 dr \right] , \quad (1.4-4)$$

where

$$f_D(r) = \frac{\sqrt{\pi}}{2} \operatorname{erf} \left( \frac{D - U(r)}{kT} \right)^{1/2} e^{-U(r)/kT} - \left( \frac{D - U(r)}{kT} \right)^{1/2} e^{-D/kT} ,$$

$f_1(r)$  is the same function except that  $D$  is replaced by  $E_1$ ,  $r_0$  is the point on the inner branch of the potential curve where  $U(r) = D$ , and  $r_1$  and  $r_2$  are the two points where  $U(r) = E_1$ . A similar but slightly longer expression can be derived for the summation appearing in Eq. (1.3-4).

The above approach omits the quasistable rotational levels above the dissociation energy (Herzberg, 1950), which some investigators include. However, such levels are more conveniently treated as two separate atoms subject to an interatomic attraction (see Section 1.6). Moreover, there is little point in including bound levels near or above the dissociation energy unless the unbound or "repulsive" states or levels of similar energy and internuclear distance are also included, since the two types make comparable contributions to the equilibrium thermodynamic properties. Inclusion of the latter type, however, requires a departure from the ideal-gas approximation.

To check the accuracy of the above relations, partition function and energy calculations for several of the states of  $N_2$ ,  $NO$ , and  $O_2$  were made using the direct summation method up to  $1/3$ ,  $1/2$ , and  $2/3$  of the dissociation energy, respectively, and the classical integrals beyond these energies. The results using the three different crossover points were virtually identical up to several thousand degrees, and agreed within 0.5 per cent for the entire range from 1000 to 40,000°K.

The total partition function and energy of diatomic molecules may be obtained by adding such contributions from all the electronic states. Of course, just as for atoms, isolated molecules have an infinite number of high-excited electronic states, while at finite densities these are "cut off" in some complicated fashion by electron-ion interactions. However, for most molecules such states lie considerably above the dissociation energy, so the molecules tend to dissociate before the choice of electronic cutoff makes much difference. In fact, unless the repulsive as well as attractive states near the dissociation energy are treated carefully, there is little point in including states above the dissociation energy (unless their fractional populations are desired for other purposes, such as radiation calculations).

In the present work, thermodynamic calculations were made for the diatomic molecules  $N_2$ ,  $N_2^+$ ,  $NO$ ,  $NO^+$ ,  $O_2^-$ ,  $O_2$ ,  $O_2^+$ , and  $CO$ , which make a significant contribution either to the thermodynamic properties or to the charged-particle concentration of equilibrium air. These calculations included all the known and predicted bound states up to the

lowest dissociation limit, and in some cases one or two states above this limit. The method used was to sum over the energy level up to half the dissociation energy of each state, where the levels were calculated using the spectroscopic data given in Table 86 of the supplementary volume. (The higher rotational constants  $D_v$  and  $H_v$ , for which data are sparse, were calculated from the vibrational constants using formulas given in Herzberg (1950).) Levels above half the dissociation energy were included by means of the classical integral, Eq. (1.4-3), using the potential curves of Figs. 1-3 to 1-5, and of Krupenie and Weissman (1965) for CO.

The results are presented in Chapter 2. Up to 6000°K they generally agree very well with those of previous workers (Gillmore, 1955; Beckett and Haar (1957); JANAF Thermochemical Panel (1960); Yungman et al., 1961; Gurvich et al., 1962; Bristow and McChesney, 1965) except for small differences due to use of more recent values for the gas constant  $R$  and the second-radiation constant  $c_2 = hc/k$ . Above 6000°K, however, the present values for most molecules begin to diverge from the older values, usually in the positive direction due to inclusion of more electronic states in the present calculation than in any previous calculation, except that of Bristow and McChesney (1965). At still higher temperatures, around 15,000 or 20,000°K, the present values cross over and fall below the few previous values available, because previous investigators effectively included some levels above the dissociation limit of each state.

### 1.5 Ideal-gas properties for polyatomic gases

The only polyatomic molecules which contribute as much as 0.01 per cent to the equilibrium thermodynamic properties of dry air are  $\text{CO}_2$  and  $\text{NO}_2$ . In addition, the negative ion  $\text{NO}_2^-$  can affect the electron concentration and hence the radio-wave absorption of high density air at a few thousand degrees, so it is desirable to include it in the equilibrium calculation.

The ideal-gas properties of polyatomic molecules can be computed by summing over their rotational, vibrational, and electronic energy levels in the same way as already described for diatomic molecules. Of course, the additional rotational and vibrational degree of freedom of the larger molecules produce a more complex set of energy levels. However, since the concentrations of polyatomic molecules generally become small above 5000 or 6000°K, the calculations can be restricted to lower temperatures, where excited electronic states and high rotational and vibrational levels can usually be neglected. This permits relatively simple approximations to the ideal-gas thermodynamic properties (Mayer and Mayer, 1940).

Results of such calculations are available in the JANAF Tables (1960) for the polyatomic molecules of present interest except  $\text{NO}_2^-$ . Thermodynamic values for the latter are tabulated in a recent report by Clifton (1966).

Since the existing ideal-gas tables for polyatomic molecules are fairly adequate for high-temperature air calculations, no further equations or tables will be presented here.

#### 1.6 Effects of interparticle forces on the thermodynamic properties of air

In the ideal-gas approximation the interactions between the molecules, atoms, ions, and electrons in high-temperature air are neglected, except when two or more particles are bound together and can be treated as a single particle. This approximation is reasonable at low air densities, but at sufficiently high densities the mean distance between free particles becomes so small that such interactions can no longer be neglected. For neutral molecules and atoms, interaction forces are very small except at distances less than about twice the intermolecular distance in the liquid or solid phase. The highest air density associated with nuclear fireballs or missile flow-fields is that produced by a strong shock wave at sea level, which is roughly  $0.01 \text{ g/cm}^3$  (about 10 times the ambient density). Since this density is about 1 per cent of that of liquid air, one may expect that neglect of intermolecular forces will produce errors of the order of one per cent in the thermodynamic properties.

At temperatures so high that the air is largely ionized, considerably greater errors can be made by neglecting the interactions between the ions and electrons. This large effect is due to the long range of the Coulomb forces between charged particles, which decrease with distance like  $1/r^2$ , in contrast to the forces between neutral molecules, which decrease like  $1/r^7$  for large values of  $r$ . As an example, consider

air at  $0.01 \text{ g/cm}^3$  and  $70,000^\circ\text{K}$ , where the major equilibrium species are  $\text{N}^+$ ,  $\text{O}^+$ , and free electrons. The ideal-gas pressure under these conditions is about 10,000 atm, while the total Coulomb force between neighboring electrons and positive ions (at their mean distance on opposite sides of a unit surface) is about 1000 atm. Accordingly, one may expect errors of the order of ten per cent in the ideal-gas approximation under these conditions. This makes it quite desirable to include corrections for charged-particle interactions in the thermodynamic calculations for air, as well as somewhat desirable to include neutral-particle interactions.

The standard method for the thermodynamic treatment of moderately dense gases is to write a virial expansion, where the first term is the ideal-gas contribution and subsequent terms give the contributions from two-particle, three-particle, etc., interactions. The virial equation for the pressure of a gas mixture may be written (Mayer and Mayer, 1940; Hirschfelder, Curtis, and Bird, 1954)

$$p = \sum_i \bar{N}_i RT + \sum_i \sum_j \bar{N}_i \bar{N}_j B_{ij}(T) RT + \sum_i \sum_j \sum_k \bar{N}_i \bar{N}_j \bar{N}_k C_{ijk}(T) RT + \dots, \quad (1.6-1)$$

where  $B_{ij}(T)$ ,  $C_{ijk}(T)$ , ... are called the second, third, etc., virial coefficients. These coefficients can be evaluated in terms of the inter-particle forces. If we treat the air particles as spherical so that they have a two-particle interaction energy  $U_{ij}$  which depends only on their distance  $r$ , the second virial coefficient is given by (Mayer and

Mayer, 1940; Hirschfelder, Curtis, and Bird, 1954)

$$B_{ij}(T) = 2\pi Q \int_0^{\infty} \left[ 1 - \exp(-U_{ij}(r)/kT) \right] r^2 dr \quad , \quad (1.6-2)$$

where  $Q$  is Avogadro's number. The expressions for the higher virial coefficients are much more complicated, but fortunately the corresponding terms in the virial expansion can generally be neglected for air densities of present interest.

A virial expansion can also be written for the internal energy, similar to Eq. (2.6-1) for the pressure, except that temperature derivatives of the virial coefficients,  $T dB_{ij}/dT$ , etc., appear instead of the coefficients themselves. Tabulations of virial coefficients for various molecules (Hirschfelder, Curtis, and Bird, 1954; Woolley, 1962) show that, at the high temperatures of present interest, such derivatives are typically an order of magnitude smaller than the coefficients themselves. This is to be expected, since the longer-range intermolecular interactions (except for Coulomb interactions) are fairly small compared to thermal energies at such temperatures, so that molecules behave roughly like rigid spheres, with virial coefficients approximately independent of temperature. Accordingly, for air densities and temperatures of present interest, it is reasonable to neglect virial corrections to the internal energy (except for charged-particle interactions; see Section 1.7).

The Helmholtz free energy is given by

$$A = A_{\text{ideal}} + VRT \sum_{\text{mixture}} \sum_j \bar{N}_i \bar{N}_j B_{ij}(T) + \dots \quad , \quad (1.6-3)$$

where  $V$  is the volume of the system. The virial corrections to the entropy and the Gibbs free energy may be obtained readily from Eqs. (1.6-1) and (1.6-3) with the help of the thermodynamic identities  $S = (E-A)/T$  and  $F = A + pV$ .

In Section 1.2 the ideal-gas expression for the chemical-equilibrium constant, in terms of partial pressures, was derived by minimizing the Gibbs free energy. For nonideal gas mixtures, however, a similar derivation is not convenient because the total pressure is no longer the sum of the individual partial pressures. The equilibrium constant may be obtained instead, by minimizing the Helmholtz free energy at constant temperature and volume. Equation (1.6-3), after substitution for the ideal free energy from Eq. (1.2-4), can be written

$$A/VRT = \sum_i \bar{N}_i \left[ F_i^0/RT - 1 + \ln(\bar{N}_i RT) \right] + \sum_i \sum_j \bar{N}_i \bar{N}_j B_{ij}(T) . \quad (1.6-4)$$

The minimization condition that the differential vanish yields, after some cancellation,

$$0 = \sum_i \left[ F_i^0/RT + \ln(\bar{N}_i RT) + 2 \sum_j \bar{N}_j B_{ij} \right] \delta \bar{N}_i . \quad (1.6-5)$$

For variations due to a single chemical reaction,  $XY \rightleftharpoons X + Y$ , one has  $\delta \bar{N}_{XY} = -\delta \bar{N}_X = -\delta \bar{N}_Y$ , while all other  $\delta \bar{N}_i$  vanish, so that Eq. (1.6-5) yields

$$\frac{\bar{N}_{XY}}{\bar{N}_X \bar{N}_Y} = RT \exp \left[ -\frac{F_{XY}^0 - F_X^0 - F_Y^0}{RT} - 2 \sum_j \bar{N}_j (B_{XY,j} - B_{Xj} - B_{Yj}) \right] . \quad (1.6-6)$$

The ideal-gas part of this equation agrees with Eq. (1.2-11).



In order to apply the relations derived above to thermodynamic calculations, numerical values for the second virial coefficients,  $B_{ij}(T)$ , are needed. For most common molecules that are stable at room temperature, values of the virial coefficients for like molecules ( $i = j$ ) and a few for unlike molecules ( $i \neq j$ ) have been measured over the easily-accessible temperature range, and extrapolated to higher temperatures by fitting an intermolecular potential according to Eq. (1.6-2) (Hirschfelder, Curtis, and Bird, 1954). Woolley (1962) has calculated and tabulated such values for air molecules up to  $15,000^{\circ}\text{K}$ . However, at high temperatures such extrapolations often give too high values. Better virial coefficients for  $\text{N}_2$  and the rare gases have been calculated by Amdur and Mason (1958), using potentials derived from molecular beam scattering. In the calculation range of 1000 to  $15,000^{\circ}\text{K}$  their values for  $\text{N}_2$  range from 0 to 19 per cent lower than those of Woolley, while their values for Ar are 10 to 23 per cent lower.

In high temperature air calculations, virial coefficients are also needed for species such as atomic N and O, for which no measurements are available. Woolley (1962) has also made estimates of these coefficients by deducing the interatomic potentials from the corresponding intermolecular potentials. For interactions not involving chemical bonding, such as N -  $\text{N}_2$  or O - Ar, his results are not unreasonable. However, better values for the N -  $\text{N}_2$  virial coefficient may be obtained by using the potential calculated by Meador (1960) using valence-bond theory. The results range from 25 to 40 per cent lower than Woolley's results, over the temperature range from 8000 to  $15,000^{\circ}\text{K}$ . It may be added that Meador's

potential, and the derived virial coefficient, are probably about 4 per cent too low, judging by a comparison of his  $N_2 - N_2$  potential with the experimental results of Amdur, Mason, and Jordan (1957).

Nonbonding potentials, at temperatures of several thousand degrees or more where the small van der Waals attraction is negligible, can usually be fit by an exponential repulsion:

$$U(r) = a e^{-cr} , \quad (1.6-7)$$

where  $a$  and  $c$  are constants which depend upon the two molecules or atoms. The integral in Eq. (1.6-2) can then be approximated by (Amdur and Mason, 1958)

$$B(T) = \frac{2\pi a_0}{3c^3} \left[ \log \frac{1.781a}{kT} \right]^3 , \quad kT \ll a . \quad (1.6-8)$$

The recommended values for the constants, obtained by increasing Meador's (1960) values by 4 per cent, are

$$\begin{aligned} N_2 - N_2: \quad a &= 833 \text{ eV}, \quad c = 2.78 \times 10^8 \text{ cm}^{-1} , \\ N - N_2: \quad a &= 363 \text{ eV}, \quad c = 2.85 \times 10^8 \text{ cm}^{-1} . \end{aligned} \quad (1.6-9)$$

Much less is known about the high-temperature interactions of other air molecules and atoms, although some theoretical calculations involving  $O_2$  ,  $NO$  , and  $O$  are available (Meador, 1960). However, these molecules and atoms, and even many of the minor air species like  $CO$  and  $C$  , are approximately the same "size" as  $N_2$  or  $N$  , and should have roughly the same high-temperature

virial coefficients. For air above 8000°K, it is reasonable, then, to use Eqs. (1.6-8) and (1.6-9a) for all neutral molecule-molecule interactions, and Eqs. (1.6-8) and (1.6-9b) for all neutral atom-molecule interactions.

Virial coefficients for interactions between neutral and charged particles, on the other hand, are generally much smaller (Woolley, 1960) because the polarization attraction counteracts the core repulsion. For present purposes it seems adequate to set them equal to zero. Coulomb interactions between charged particles will be considered later, in Section 1.7.

Interactions involving chemical bonding, such as the important N - N , N - O , and O - O interactions, cannot be adequately treated by considering only a single interaction potential. Instead, as shown in Figs. 1-3, 1-4, and 1-5, the two atoms may approach each other on any of several potential curves, depending on the relative orientation of their electrons. The correct virial coefficient to use is a weighted average of the values computed using the various curves, where the proper weights are the statistical weights of the molecular states (see Section 1.4), and contributions of those states or levels already included in the molecular partition function should be omitted here.

The present calculations of the partition function and thermodynamic properties of diatomic molecules, described in Section 1.4, include for all the lower electronic states every rotational-vibrational level below the corresponding dissociation energy. For attractive potentials, to be consistent, the virial integral of Eq. (1.6-2) must then

be replaced by one which omits contributions from bound states. The result, after taking the weighted average over the different electronic states  $n$ , is

$$B(T) = \frac{2\pi q}{\sum_n g_n} \sum_n g_n \int_0^\infty r^2 dr \left[ 1 - \left( e^{-U_n/kT} \right)_{U_n > 0} - \frac{2}{kT/\pi kT} \int_{U_n < 0}^\infty (E - U_n)^{1/2} e^{-E/kT} dE \right] \quad (1.6-10)$$

where for simplicity the subscripts  $ij$  designating the interacting atoms, and the variation of  $U_n$  with  $r$ , are not explicitly indicated. The last integral in Eq. (1.6-10) can also be expressed in terms of the error function, as in Eq. (1.4-3).

Sample calculations for nitrogen and oxygen atoms at high temperatures were carried out using Eq. (1.6-10). They gave second virial coefficients almost an order of magnitude smaller than those involving molecules, because negative contributions from nonbound levels in the attractive potentials largely cancelled the positive contributions from the repulsive cores. Accordingly, for present purposes the atom-atom virial corrections can be neglected.

It might be mentioned that when high-temperature diatomic partition functions are calculated by integrating over all portions of the potential curves and all energies, as done by Beckett and Haar (1957) and Bristow and McChesney (1965), instead of cutting them off at the dissociation energy as done in Section 1.4, the corresponding atom-atom virial correction is already included implicitly in the molecular thermodynamics. The only remaining contributions to the coefficient are those from any electronic

states not included in the diatomic integration. In principle, the diatomic partition functions could include all electronic states, thus making the atom-atom virial coefficients vanish identically, but in practice the purely-repulsive states are usually omitted from the molecular treatment. The corresponding second virial coefficients, obtained by summing Eq. (1.6-10) only over the repulsive states, are somewhat larger than those obtained by using the complete sum, but still only about half as large as the coefficients estimated by Woolley (1960) by scaling down the molecule-molecule potentials.

#### 1.7 Effects of Coulomb forces on the thermodynamic properties of ionized air

The Coulomb forces between the ions and electrons present in high-temperature air are sufficiently different from the intermolecular forces already considered as to require a separate treatment. When  $U_{ij}(r) = \text{constant}/r$ , the integral in Eq. (1.6-2) is found to diverge at  $r = 0$  when the constant is negative (i.e., for charged particles of opposite sign), while for large  $r$  it behaves like  $\pm \int r dr$  and diverges for both positive and negative Coulomb potentials. The divergence at  $r = 0$  is due to inclusion of bound states; it may be removed by including only the states with energies above that of the separated particles, by use of Eq. (1.6-10). The divergence at  $r = \infty$ , however, is more fundamental. A uniform gas of charged particles which is not electrically neutral (i.e., has more positive than negative charges, or vice versa) can be shown to have a Coulomb energy per unit mass which depends upon the size and shape of the gas volume considered, and becomes infinite as

the volume goes to infinity (at fixed gas density). It is not surprising, then, that the virial coefficients for a Coulomb potential diverge. In an ionized gas with no net charge, the infinite positive and negative virial terms from the repulsive and attractive Coulomb forces, respectively, must somehow cancel to first order, leaving only a finite remainder.

If the charged-particle density is not too high, this problem can be treated by the Debye-Hückel theory, which determines the mean distribution of electrons and ions around any given electron or ion, using a linearized self-consistent-field approximation. Since the derivation and results are available in several texts (Fowler, 1936; Fowler and Guggenheim, 1956; Cambel, Duclos, and Anderson, 1963) they will not be reproduced here. Qualitatively, the effect of Coulomb interactions is to decrease the effective ionization potential of each species, and thus increase the degree of ionization. The interactions also decrease the pressure and energy of the ionized gas mixture directly, in contrast to the indirect increase due to the increased ionization, so that the net thermodynamic corrections are positive at some temperatures and densities and negative at others.

For present purposes, however, the conventional Debye-Hückel treatment needs to be supplemented by two additional considerations. The first concerns the dielectric constant. The original analysis of Debye and Hückel was applied to ions in solution, and since the force between adjacent ions is affected by the polarizability of the intervening liquid, the dielectric constant of the latter enters into the basic equations. A similar effect may be expected in an ionized gas whenever molecules, atoms, or polarizable ions are situated between neighboring ions, but in

gases the continuum fluid approximation and the use of the static dielectric constant will be less accurate. Fortunately, at gas densities and temperatures of present interest, the dielectric constant will not deviate more than a couple per cent from that of empty space, so that it can be approximated by the latter value, with an error less than the other errors inherent in the Debye-Hückel approach.

The second consideration involves the electronic-state "cutoff" introduced in Section 1.3. Conventional Debye-Hückel theory does not consider electronically-excited states. It does, however, give for the mean potential about each ion of charge  $Z$  :

$$U(r) = (Ze/r) \exp (-r/d) \quad , \quad (1.7-1)$$

where  $d$  is the Debye length, given by

$$d^2 = kT / \left( 4\pi e^2 \sum_i \bar{N}_i Z_i^2 \right) \quad , \quad (1.7-2)$$

and the summation is taken over all charged particles, including electrons. Some workers have assumed that the higher excited states of each atom or ion are precisely the bound states of an electron in the Debye-Hückel potential, Eq. (1.7-1). This potential has only a finite number of bound states, so that the partition function converges. However, these states include a number having classical electron orbits with radii approaching the Debye length. Since the Debye-Hückel treatment is valid only when the Debye length is longer than the mean distance between ions (Cambel, Duclos, and Anderson, 1963), such states have a bound electron which is generally closer to other ions than to the ion to which it is presumed to be

bound. This is not reasonable. Moreover, from the viewpoint of classical statistical mechanics, in which an electron is characterized by a position and a momentum or energy, it is clear that such a procedure will give a partition function which counts portions of phase space more than once.

A better procedure is suggested by the classical approach: The entire volume of the gas can be divided into approximately spherical volume elements surrounding each ion, and the bound states within each element calculated. The volume elements may be taken of equal size, but when ions of different charges are present it is preferable to make the size of each element proportional to the charge of the ion it contains. Since the radii of the volume elements are smaller than the Debye-Hückel length  $d$ , it is reasonable to omit the exponential factor in Eq. (1.7-1), leaving just the ordinary Coulomb field. The lower bound states of electrons in this field will be just the Rydberg states already described in Section 1.3, while the higher ones will deviate due to the finite volume. However, for gas densities of present interest the latter states are high enough to be approximated classically. Classically, the bound electron is unaffected by the finite volume until its energy is sufficient to permit it to reach the boundary, at which point it ceases to be bound. This principle gives a cutoff quantum number for substitution in Eq. (1.3-10):

$$n_c^2 = Ry (Z + 1) r_{Z+1} / e^2, \quad (1.7-3)$$

where  $r_{Z+1}$  is the radius of the volume element about an ion of charge  $Z + 1$  ( $Z + 1$  appears instead of  $Z$  because a highly-excited atom or ion of charge  $Z$  is treated like an ion of charge  $Z + 1$  plus an outer electron.)



### 1.3 Equilibrium calculations and results for air

Based on the theoretical relations presented in the preceding sections, a FORTRAN code has been written and equilibrium calculations carried out for air between 10,000 and 10,000,000°K, including the Debye-Hückel, variable electronic cutoff, and second virial corrections. The iteration process selected, based on the assumption that the molecular concentrations are smaller than the atomic ones, failed to converge for temperatures below 10,000°K at high densities. No attempt was made to modify it, due to lack of time and the adequacy of the earlier results of Hilsenrath and Klein (1963, 1965) in this lower temperature region.

The basic composition of normal air, used as input, was about the same as that used previously (Gilmore, 1955, 1959; Hilsenrath and Klein, 1963, 1965), except that the CO<sub>2</sub> concentration was decreased slightly in accordance with recent measurements (Kelley and La Chapelle, 1966), and the small amount of neon was lumped in with the argon. This gives the initial composition shown below:

<u>Molecule</u>	<u>Mole per cent</u>
N <sub>2</sub>	78.084
O <sub>2</sub>	20.946
Ar	0.938
CO <sub>2</sub>	0.032

The density range covered was from  $10^{-9}$  to 10 times standard density, where the standard density is  $1.2923 \times 10^{-3} \text{ g/cm}^3$ , corresponding to the ideal gas mixture at  $273.15^\circ\text{K}$  and 1 atm pressure. At the lowest density considered the assumption of thermodynamic equilibrium might seem unrealistic in most practical situations. However, for energy densities corresponding to temperatures above about  $10,000^\circ\text{K}$  many free electrons are usually present, and characteristic times for these electrons to equilibrate with each other and with the ion excitation and ionization are only a few milliseconds. Of course, equilibration of ion velocities will take a longer time (though often still short compared to radiative or hydrodynamic cooling times of large masses of air), but the ion kinetic energies make only a relatively small contribution to the total energy and pressure at the higher temperatures. Radiation will also depopulate nonmetastable states below their equilibrium concentrations, but even in equilibrium their populations are small, since at low densities ions tend to ionize further rather than become excited.

The calculated equilibrium compositions are presented graphically in Figs. 2.1 to 2.8. The concentrations of most species agree within a percent with the values of Hilsenrath and Klein (1963, 1965) up to  $15,000^\circ\text{K}$ , after correcting for the 3 percent smaller initial  $\text{CO}_2$  concentration used in the present work. There are, however, differences of several percent in the molecular concentrations, due to use of improved diatomic thermodynamic properties and virial coefficients. Moreover, the  $\text{O}^-$  concentration is up to a factor of 2 lower, and the  $\text{O}_2^-$  concentration a couple orders of magnitude higher due to use of revised electron affinities. However, at all temperatures and densities considered the negative ion densities are more than an order of magnitude below the electron densities.

The calculated equilibrium thermodynamic properties are presented in Tables 102 to 111. These values agree within 1 percent with those of Hilsenrath and Klein up to 15,000°K. They also agree within 2 percent with the earlier values of the writer (Gilmcre, 1954, 1959) up to 24,000°K, and of Hilsenrath, Green, and Beckett (1957) up to 5,000,000°K, except for differences of several percent at the higher densities due to omission of virial and Debye-Hückel corrections from the earlier work.

## References

- Amdur, I., E.A. Mason, and J.E. Jordan, *J. Chem. Phys.* **27**, 527, 1957.
- Amdur, I. and E.A. Mason, *Phys. Fluids* **1**, 370, 1958.
- Beckett, C.W. and L. Haar, *Proc. Joint Conf. on Thermodyn. and Transport Properties of Fluids*, p. 27, *Instit. of Mech. Engineers, London*, 1957.
- Bristow, M.P.F. and M. McChesney, *Proc. Phys. Soc.* **85**, 1237, 1965.
- Cambel, A.B., D.P. Duclos, and T.P. Anderson, *Real Gases*, Academic Press, New York, 1963.
- Clifton, D.G., Approximate Thermodynamic Functions for the  $\text{NO}_2^-(g)$  Ion, General Motors Defense Research Laboratories, TR66-01F, May, 1966.
- Edlen, B., *Atomic Spectra*, *Handbuch der Physik*, Vol. XXVII, p. 80, Springer-Verlag, Berlin, 1964.
- Epstein, P.S., *Textbook of Thermodynamics*, J. Wiley and Sons, New York, 1937.
- Fowler, R.H., *Statistical Mechanics*, 2nd. ed., Cambridge Univ. Press, London, 1936.
- Fowler, R.H. and E.A. Guggenheim, *Statistical Thermodynamics*, Cambridge Univ. Press, London, 1956.
- Gilmore, F.R., Equilibrium Composition and Thermodynamic Properties of Air to 24,000°K, The RAND Corporation, RM-1543, Aug., 1955.
- Gilmore, F.R., Additional Values for the Equilibrium Composition and Thermodynamic Properties of Air, The RAND Corporation, RM-2328, Dec., 1959.
- Gilmore, F.R., *JQSRT* **5**, 369, 1965.
- Green, J.W., D.E. Poland, and J.L. Margrave, *J. Chem. Phys.* **33**, 35, 1960.
- Gurvich, L.V., et al., *Termodinamicheskie Svoistva Individualnykh Veshchestv* [Thermodynamic Properties of Individual Substances], Vol. II, Acad. Sci. USSR, Moscow, 1962.
- Herzberg, G., *Atomic Spectra and Atomic Structure*, Dover Publications, New York, 1944.
- Herzberg, G., *Spectra of Diatomic Molecules*, 2nd ed., Van Nostrand Co., New York, 1950.

- Hilsenrath, J., C.G. Messina, and W.H. Evans, Tables of Ideal Gas Thermodynamic Functions for 73 Atoms and Their First and Second Ions to 10,000°K, Air Force Weapons Laboratory, AFWL TDR-64-44, 1944.
- Hilsenrath, J., M.S. Green, and C.W. Beckett, Thermodynamic Properties of Highly Ionized Air, National Bureau of Standards, AFSWC-TR-56-35, 1957. (Shorter version in the Proceedings of the Ninth International Astronautical Congress, Amsterdam, 1958; Springer-Verlag, Vienna, 1959).
- Hilsenrath, J., and M. Klein, Tables of Thermodynamic Properties of Air in Chemical Equilibrium Including Second Virial Corrections from 1500°K to 15,000°K, Arnold Eng. Dev. Center, U.S. Air Force, AEDC-TDR-63-161, August 1963; AEDC-TR-65-58, March, 1965.
- Hirschfelder, J.O., C.F. Curtiss, and R.B. Bird, Molecular Theory of Gases and Liquids, J. Wiley & Son, New York, 1954.
- Hochstim, A. and B. Adams, Progress in International Research on Thermodynamic and Transport Properties, Am. Soc. Mech. Eng., Academic Press, New York, 1962, p. 228.
- Hochstim, A.R., Theoretical Calculations of Thermodynamic Properties of Air, Proc. Fifth AGARD Combustion and Propulsion Colloquium, Pergamon Press, London, 1963. (Reproduced in Hilsenrath and Klein, 1963, 1965).
- Joint Army-Navy-Air Force Thermochemical Panel, IANAF Thermochemical Tables, Dow Chemical Company, 1960 (and later supplements).
- Kelley, J.J. and E. La Chapelle, J. Geophys. Res. 71, 2173, 1966.
- Kolsky, H.G., R.M. Gilmer, and P.W. Gilles, J. Chem. Phys. 27, 494, 1957.
- Krupenie, P.H. and S. Keissman, J. Chem. Phys. 43, 1529, 1965.
- Martinez, M.R., Evaluation of Thermodynamic and Reaction Equilibrium Properties of Gases by Statistical Mechanics, Douglas Aircraft Co., Research Report SM40002, 1961.
- Mayer, J.E. and M.G. Mayer, Statistical Mechanics, J. Wiley and Sons, New York, 1940.
- McBride, B.J., et al., Thermodynamic Properties to 6000°K for 210 Substances Involving the First 18 Elements, Nat. Aeron. Space Admin., NASA SP-3001, 1963.
- Meador, W.E., Jr., The Interactions between Nitrogen and Oxygen Molecules, NASA TR R-68, 1960.

Moore, C.E., Atomic Energy Levels, Vol. I, National Bureau of Standards, Circular 467, June 15, 1949. (See errata at end of Vols. II and III.)

Nat. Acad. Sci. - Nat. Res. Council, Physics Today 17, 48, 1964.

Vanderslice, J.T., E.A. Mason, and E.R. Lippincott, J. Chem. Phys. 30, 129, 1959.

White, W.B., S.M. Johnson, and G.B. Dantzig, J. Chem. Phys., 28, 751, 1958.

Woolley, H.W., Thermodynamic Functions for Atomic Ions, Air Force Special Weapons Center, AFSWC-TR-56-34, 1957.

Woolley, H.W., The Calculation of Thermodynamic Properties of Gases at High Temperatures, Air Force Special Weapons Center, AFSWC-TDR-62-21, Mar., 1962.

Yungman, V.S., et al., Russ. J. Phys. Chem. 35, 1073, 1961.



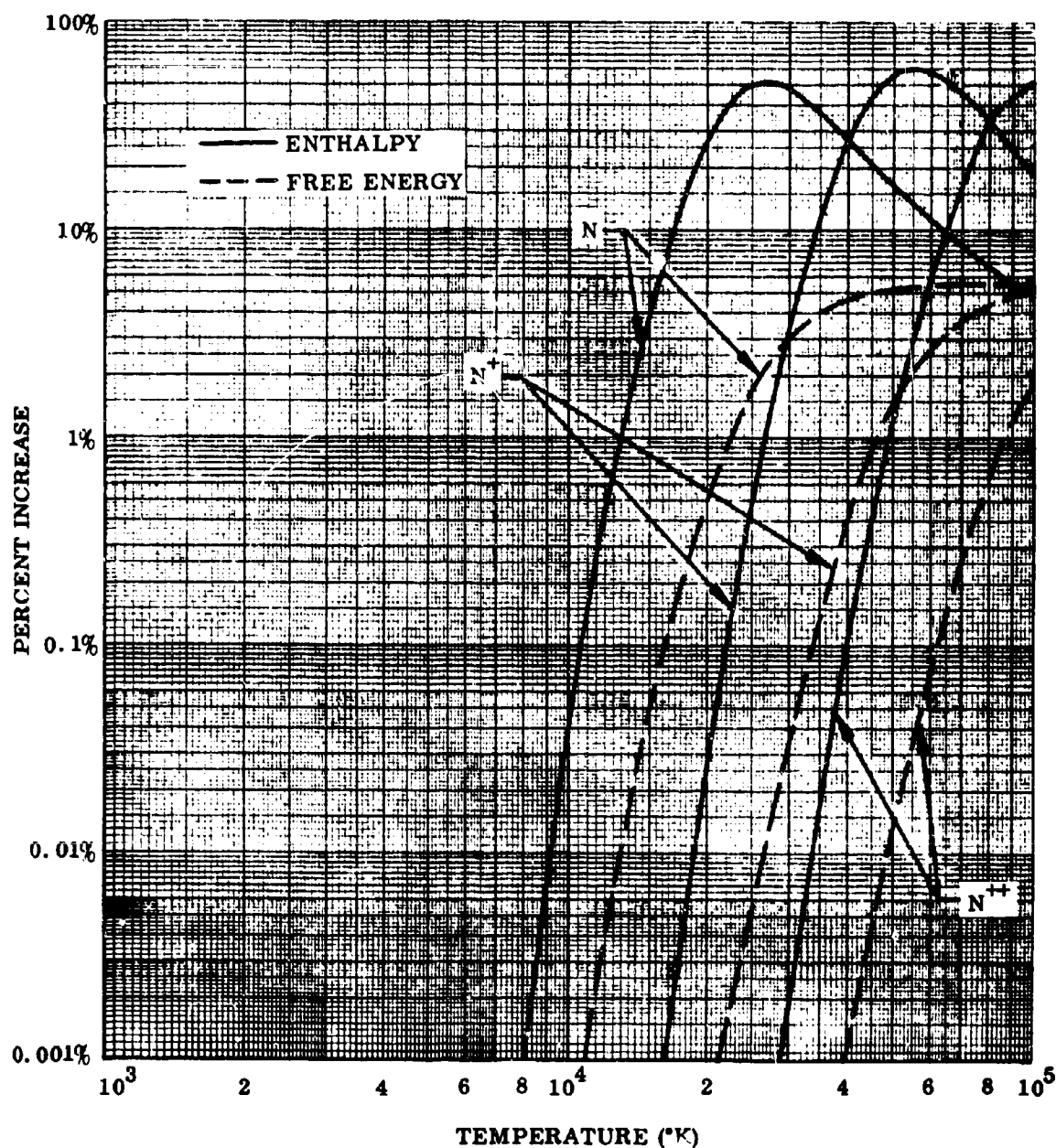
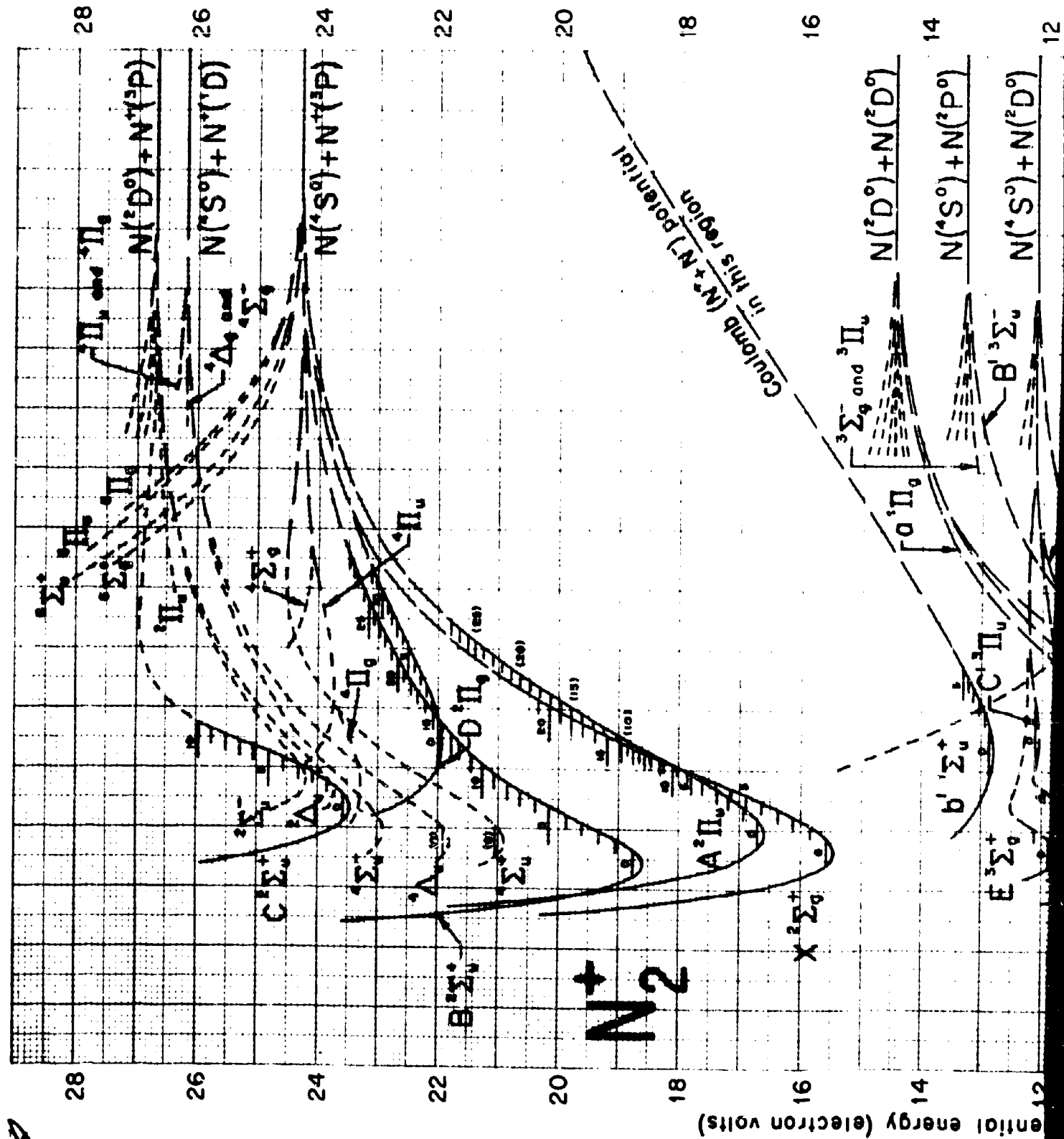


FIG. 1-2 PERCENT INCREASE IN THERMODYNAMIC FUNCTIONS FOR NITROGEN ATOMS AND IONS DUE TO SUMMING OVER ELECTRONIC LEVELS WITH  $n \leq 8$  INSTEAD OF  $n \leq 4$ .







2

24 22 20 18 16 14 12 10 8

24 22 20 18 16 14 12 10 8

24 22 20 18 16 14 12 10 8

24 22 20 18 16 14 12 10 8

24 22 20 18 16 14 12 10 8

24 22 20 18 16 14 12 10 8

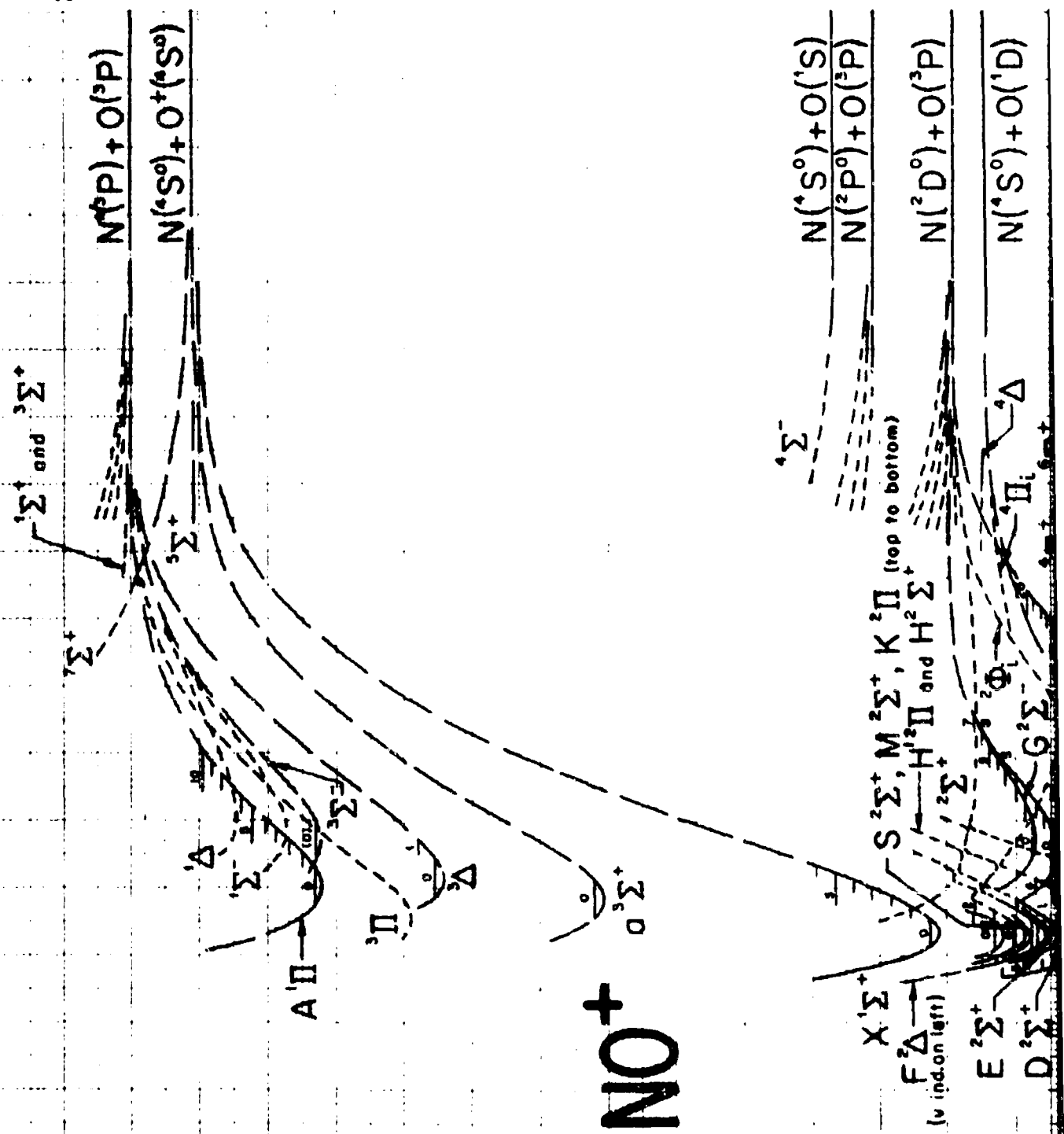
24 22 20 18 16 14 12 10 8

24 22 20 18 16 14 12 10 8

24 22 20 18 16 14 12 10 8

**NO<sup>+</sup>**

Potential energy (electron volts)



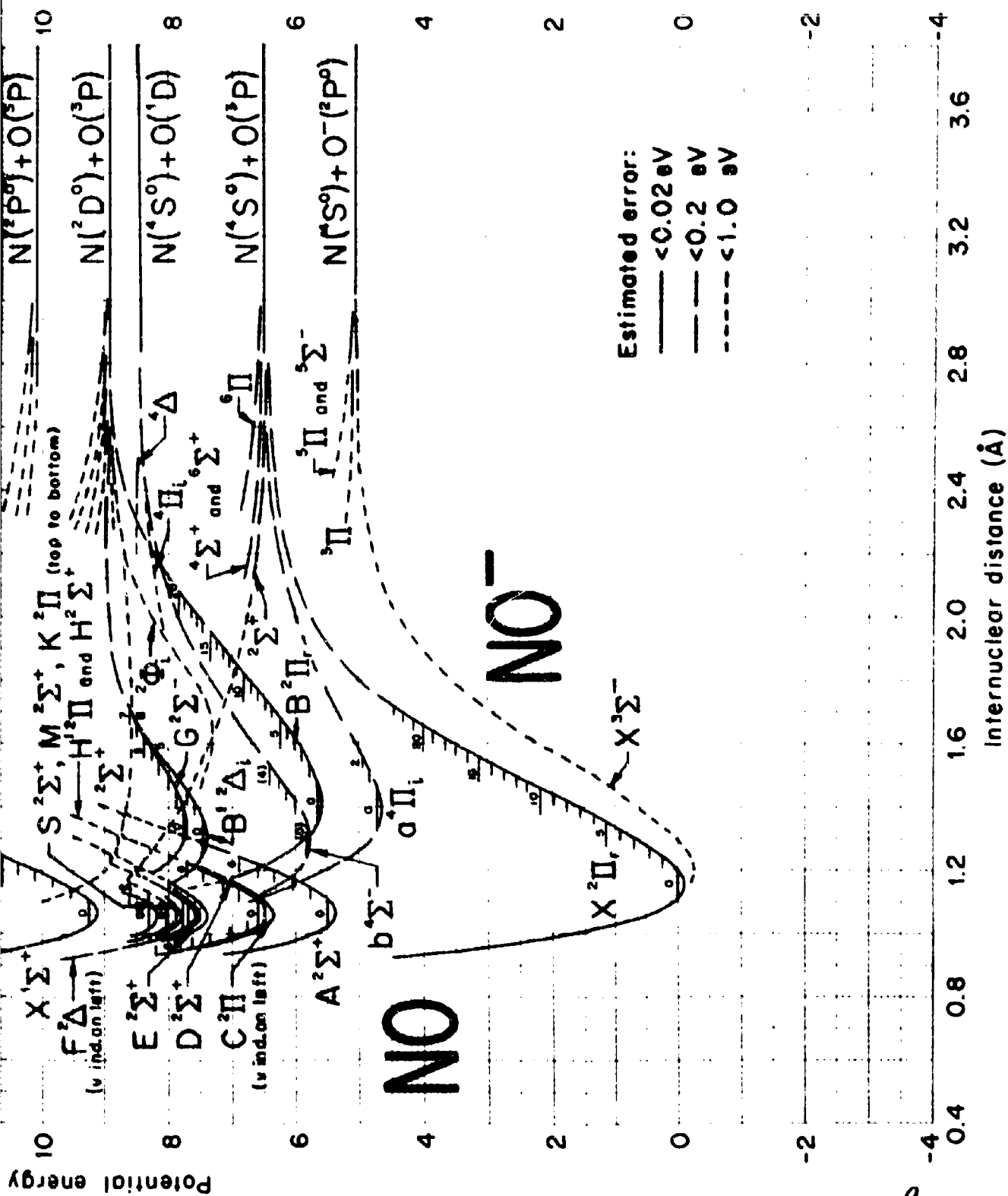
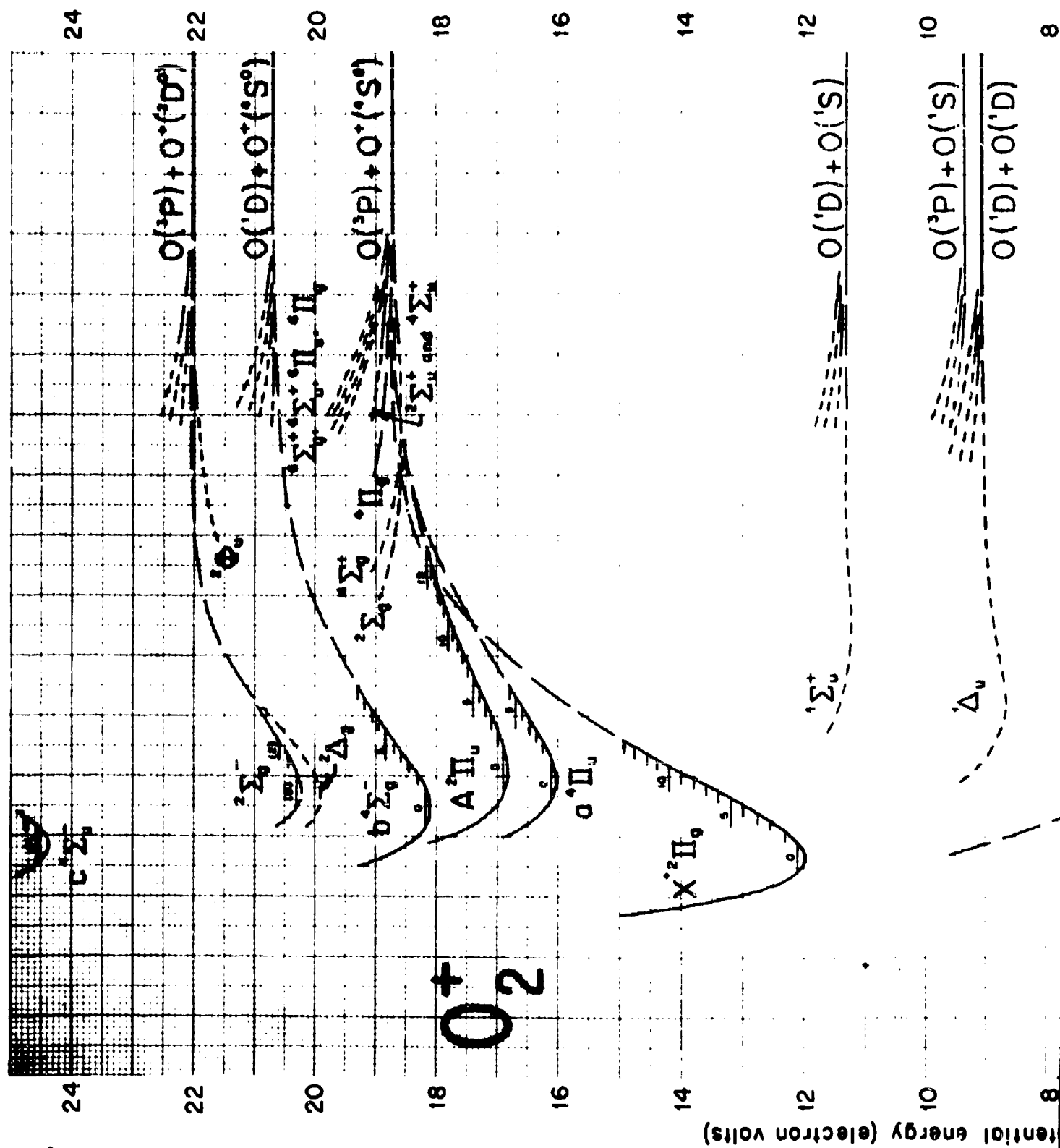


FIG. 1-4 POTENTIAL-ENERGY CURVES FOR  $\text{NO}^-$ ,  $\text{NO}$  and  $\text{NO}^+$ .





**BLANK PAGE**

## Chapter 2. THE EQUILIBRIUM THERMODYNAMIC PROPERTIES OF HIGH-TEMPERATURE AIR: TABLES AND GRAPHS

This Chapter contains the following material:

1. Energy Zero for Air Species: Table 1.
2. Ideal-Gas Properties for Monatomic Air Species: Tables 2-45.
3. Energy Levels and Fractional Electronic Populations for Monatomic Air Species: Tables 46-85.
4. Spectroscopic Constants for Diatomic Air Species: Table 86.
5. Ideal-Gas Properties for Diatomic Air Species: Tables 87-94.
6. Fractional Electronic Populations for Diatomic Air Species: Tables 95-101.
7. Dimensionless Pressure, Pressure and Log of Pressure of Equilibrium Air,  $10^4$  to  $10^7$  °K,  $10^{-9}$  to 10 Fold Sea Level Air Density: Tables 102-104.
8. Dimensionless Internal Energy, Internal Energy and Internal Energy Density of Equilibrium Air, Same Temperature and Density Range As Above: Tables 105-107.
9. Enthalpy of Equilibrium Air, Same Temperature and Density Range As Above: Table 108.
10. Effective Gamma of Equilibrium Air, Same Temperature and Density Range As Above: Table 109.
11. Dimensionless Entropy of Equilibrium Air, Same Temperature and Density Range as Above: Table 110.
12. Equilibrium Composition of Air,  $10^4$  to  $10^7$  °K,  $10^{-6}$  fold to Normal Sea Level Air Density: Figs. 2-1 to 2-8.



Table 1. Energy of Air Particles at 0°K

Species	$E_0^0(\text{cm}^{-1})$	Species	$E_0^0(\text{cm}^{-1})$	Species	$E_0^0(\text{cm}^{-1})$
CO <sub>2</sub>	0	N	39,359	Ar	0
NO <sub>2</sub>	3,065	N <sup>+</sup>	156,573	Ar <sup>+</sup>	127,110
NO <sub>2</sub> <sup>-</sup>	-29,100	N <sup>++</sup>	395,324	Ar <sup>++</sup>	349,958
N <sub>2</sub>	0	N <sup>3+</sup>	777,950	Ar <sup>3+</sup>	679,924
N <sub>2</sub> <sup>+</sup>	125,667	N <sup>4+</sup>	1,402,801	Ar <sup>4+</sup>	1,162,300
NO	7,506	N <sup>5+</sup>	2,192,317	Ar <sup>5+</sup>	1,767,400
NO <sup>+</sup>	82,253	N <sup>6+</sup>	6,645,117	Ar <sup>6+</sup>	2,504,000
O <sub>2</sub> <sup>-</sup>	-3,470	N <sup>7+</sup>	12,025,206	Ar <sup>7+</sup>	3,504,000
O <sub>2</sub>	0	O <sup>-</sup>	8,705	Ar <sup>8+</sup>	4,661,800
O <sub>2</sub> <sup>+</sup>	97,295	O	20,630	Ar <sup>9+</sup>	8,069,100
CO	23,351	O <sup>+</sup>	130,467	Ar <sup>10+</sup>	11,930,000
C	92,315	O <sup>++</sup>	413,711	Ar <sup>11+</sup>	16,277,000
C <sup>+</sup>	183,129	O <sup>3+</sup>	856,518	Ar <sup>12+</sup>	21,263,600
C <sup>++</sup>	379,788	O <sup>4+</sup>	1,480,915	Ar <sup>13+</sup>	26,797,400
C <sup>3+</sup>	766,002	O <sup>5+</sup>	2,399,617	Ar <sup>14+</sup>	32,892,900
C <sup>4+</sup>	128,179	O <sup>6+</sup>	3,513,617	Ar <sup>15+</sup>	39,787,100
C <sup>5+</sup>	4,448,629	O <sup>7+</sup>	9,476,617	Ar <sup>16+</sup>	47,196,400
C <sup>6+</sup>	8,400,690	O <sup>8+</sup>	16,505,010	Ar <sup>17+</sup>	80,386,400
				Ar <sup>18+</sup>	116,086,300

TABLE 2. IDEAL GAS FUNCTIONS FOR O- (ATOMIC WEIGHT 15.9999, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $N \leq 4$ . SEE TABLE 46 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2 - E_0}{RT}$	$\ln \frac{h^2 - E_0}{RT} - \frac{E_0 - E_0}{RT}$	$\frac{S^0}{R}$	$\ln \frac{h^2 - E_0}{RT} - \frac{E_0 - E_0}{RT}$	$\frac{S^0}{R}$	$E^0 - E_0$	$\frac{h^2 - E_0}{RT} - \frac{E_0 - E_0}{RT}$	$\frac{h^2 - E_0}{RT} - \frac{E_0 - E_0}{RT}$	TEMP. (°K)
1000	5.3272	2.60216	19.4361	22.0383	5.17092	38.4228	3.1838E 03	5.1709E 03	3.8623E 04	1000
1200	5.4311	2.58958	19.9094	22.0980	5.14592	39.5633	4.7052E 03	5.1459E 03	4.7474E 04	1200
1400	5.4922	2.57858	20.3078	22.0875	5.13405	40.3550	4.3944E 03	5.1340E 03	5.4497E 04	1400
1600	5.5478	2.57150	20.6517	22.2232	5.11000	41.0384	4.0944E 03	5.1100E 03	6.5661E 04	1600
1800	5.5926	2.56487	20.9542	23.5191	5.09682	41.6395	3.8974E 03	5.1193E 03	7.4951E 04	1800
2000	5.6292	2.55934	21.2242	23.7835	5.08583	42.1759	3.6973E 03	5.1072E 04	8.4352E 04	2000
2200	5.6599	2.55466	21.4679	24.0225	5.07654	42.7367	3.4966E 03	5.1168E 04	9.3852E 04	2200
2400	5.6859	2.55066	21.6900	24.2406	5.06858	43.1015	3.2952E 03	5.1268E 04	1.0344E 05	2400
2600	5.7082	2.54720	21.8940	24.4412	5.06170	43.5070	3.0938E 03	5.1368E 04	1.1312E 05	2600
2800	5.7275	2.54417	22.0826	24.6268	5.05569	43.8819	2.8923E 03	5.1468E 04	1.2287E 05	2800
3000	5.7445	2.54151	22.2561	24.7995	5.05040	44.2305	2.6907E 03	5.1515E 04	1.3264E 05	3000
3200	5.7595	2.53915	22.4220	24.9612	5.04570	44.5563	2.4892E 03	5.1544E 04	1.4250E 05	3200
3400	5.7728	2.53704	22.5759	25.1129	5.04151	44.8620	2.2877E 03	5.1541E 04	1.5235E 05	3400
3600	5.7847	2.53514	22.7209	25.2540	5.03775	45.1501	2.0862E 03	5.1513E 04	1.6254E 05	3600
3800	5.7954	2.53343	22.8578	25.3913	5.03434	45.4224	1.8847E 03	5.1479E 04	1.7261E 05	3800
4000	5.8051	2.53188	22.9878	25.5197	5.03126	45.6805	1.6832E 03	5.1440E 04	1.8272E 05	4000
4200	5.8140	2.53046	23.1113	25.6417	5.02845	45.9259	1.4817E 03	5.1396E 04	1.9289E 05	4200
4400	5.8220	2.52917	23.2290	25.7581	5.02587	46.1598	1.2802E 03	5.1348E 04	2.0310E 05	4400
4600	5.8294	2.52798	23.3414	25.8693	5.02350	46.3832	1.0787E 03	5.1296E 04	2.1336E 05	4600
4800	5.8362	2.52688	23.4489	25.9758	5.02132	46.5969	877.1E 02	5.1240E 04	2.2367E 05	4800
5000	5.8425	2.52586	23.5521	26.0779	5.01931	46.8018	675.6E 02	5.1181E 04	2.3401E 05	5000
5200	5.8483	2.52492	23.6511	26.1760	5.01744	46.9987	474.1E 02	5.1119E 04	2.4439E 05	5200
5400	5.8538	2.52405	23.7464	26.2704	5.01570	47.1860	272.6E 02	5.1055E 04	2.5482E 05	5400
5600	5.8588	2.52323	23.8382	26.3614	5.01408	47.3704	71.1E 01	5.0991E 04	2.6527E 05	5600
5800	5.8635	2.52247	23.9267	26.4492	5.01251	47.5463	5.6E 00	5.0937E 04	2.7577E 05	5800
6000	5.8679	2.52175	24.0122	26.5340	5.01114	47.7162	3.6E 00	5.0884E 04	2.8630E 05	6000
6200	5.8720	2.52108	24.0949	26.6160	5.00981	47.8805	1.6E 00	5.0831E 04	2.9686E 05	6200
6400	5.8759	2.52045	24.1749	26.6954	5.00856	48.0395	5.0E 00	5.0778E 04	3.0745E 05	6400
6600	5.8795	2.51986	24.2525	26.7723	5.00738	48.1936	3.0E 00	5.0725E 04	3.1805E 05	6600
6800	5.8830	2.51930	24.3277	26.8470	5.00627	48.3431	1.0E 00	5.0672E 04	3.2873E 05	6800
7000	5.8862	2.51877	24.4007	26.9195	5.00522	48.4882	5.0E 00	5.0619E 04	3.3942E 05	7000
7200	5.8893	2.51827	24.4716	26.9899	5.00422	48.6292	3.0E 00	5.0566E 04	3.5013E 05	7200
7400	5.8922	2.51779	24.5404	27.0584	5.00327	48.7663	1.0E 00	5.0513E 04	3.6087E 05	7400
7600	5.8950	2.51734	24.6078	27.1251	5.00238	48.8997	5.0E 00	5.0460E 04	3.7164E 05	7600
7800	5.8976	2.51692	24.6732	27.1901	5.00153	49.0296	3.0E 00	5.0407E 04	3.8243E 05	7800
8000	5.9001	2.51651	24.7369	27.2534	5.00072	49.1563	1.0E 00	5.0354E 04	3.9323E 05	8000
8200	5.9024	2.51612	24.7990	27.3151	4.99994	49.2797	5.0E 00	5.0301E 04	4.0404E 05	8200
8400	5.9047	2.51575	24.8596	27.3754	4.99920	49.4002	3.0E 00	5.0248E 04	4.1485E 05	8400
8600	5.9069	2.51539	24.9188	27.4342	4.99850	49.5178	1.0E 00	5.0195E 04	4.2565E 05	8600
8800	5.9089	2.51505	24.9767	27.4917	4.99783	49.6327	5.0E 00	5.0142E 04	4.3647E 05	8800
9000	5.9109	2.51473	25.0332	27.5479	4.99718	49.7450	3.0E 00	5.0089E 04	4.4731E 05	9000
9200	5.9128	2.51442	25.0884	27.6029	4.99657	49.8549	1.0E 00	5.0036E 04	4.5816E 05	9200
9400	5.9146	2.51412	25.1425	27.6566	4.99597	49.9623	5.0E 00	5.0036E 04	4.6902E 05	9400
9600	5.9164	2.51384	25.1954	27.7093	4.99541	50.0675	3.0E 00	5.0036E 04	4.7988E 05	9600
9800	5.9180	2.51356	25.2473	27.7608	4.99486	50.1705	1.0E 00	5.0036E 04	4.9074E 05	9800

TABLE 2 (CONT.). IDEAL GAS FUNCTIONS FOR O-

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2}{RT}$	$\frac{h^2}{RT} - \frac{5}{2}$	$\ln \frac{h^2}{RT}$	$\ln \frac{h^2}{RT} - \frac{5}{2}$	$\ln \frac{h^2}{RT} - \frac{5}{2}$	$\ln \frac{h^2}{RT} - \frac{5}{2}$	$\ln \frac{h^2}{RT} - \frac{5}{2}$	$\ln \frac{h^2}{RT} - \frac{5}{2}$	$\ln \frac{h^2}{RT} - \frac{5}{2}$	TEMP. (°K)
10000	5.9196	2.5133	25.5965	27.8113	4.99434	50.2714	55.2637	3.0072E 04	4.9943E 04	5.271E 05	10000
10500	5.9234	2.51268	25.5207	27.9333	4.99311	50.5150	55.5002	3.1562E 04	5.2620E 04	5.3001E 05	10500
11000	5.9268	2.51212	25.5375	28.0497	4.99200	50.7473	55.7393	3.3053E 04	5.4912E 04	5.5022E 05	11000
11500	5.9299	2.51150	25.5492	28.1608	4.99097	50.9632	55.9602	3.4544E 04	5.7394E 04	5.8619E 05	11500
12000	5.9328	2.51113	25.5561	28.2672	4.99004	51.1816	56.1716	3.6034E 04	5.9900E 04	6.3161E 05	12000
12500	5.9355	2.51070	25.5596	28.3693	4.98917	51.3953	56.3764	3.7523E 04	6.2362E 04	6.8232E 05	12500
13000	5.9379	2.51029	25.5570	28.4673	4.98837	51.6093	56.5693	3.9014E 04	6.4694E 04	7.3894E 05	13000
13500	5.9402	2.50992	25.5518	28.5617	4.98763	51.7642	56.7568	4.0504E 04	6.7333E 04	8.0066E 05	13500
14000	5.9423	2.50957	25.5430	28.6526	4.98694	51.9505	56.9375	4.1997E 04	6.9817E 04	8.7273E 05	14000
14500	5.9442	2.50925	25.5311	28.7403	4.98629	52.1255	57.1118	4.3487E 04	7.2301E 04	9.5502E 05	14500
4.4978E 04	7.4789E 04	7.8442E 05	15500	5.9478	2.50864	26.3904	28.9071	4.90313	52.4580	57.4432	
BAD BLOCK SKIPPED											
16500	5.9509	2.50819	25.5253	28.8434	4.98610	52.2697	57.2538	4.8442E 04	8.2230E 04	8.7070E 05	16500
17000	5.9523	2.50791	25.5201	28.9380	4.98563	52.4905	57.5021	5.0040E 04	8.4722E 04	9.0961E 05	17000
17500	5.9537	2.50769	25.5105	29.0319	4.98519	53.0629	58.0461	5.2430E 04	8.7204E 04	9.2040E 05	17500
18000	5.9550	2.50748	25.5033	29.1209	4.98477	53.2033	58.1863	5.3921E 04	8.9690E 04	9.5764E 05	18000
18500	5.9562	2.50728	25.4945	29.2134	4.98438	53.3398	58.3222	5.5411E 04	9.2174E 04	9.8679E 05	18500
19000	5.9573	2.50709	25.4890	29.3161	4.98400	53.4727	58.4567	5.6902E 04	9.4650E 04	1.0160E 06	19000
19500	5.9584	2.50691	25.4841	29.4181	4.98365	53.6021	58.5887	5.8392E 04	9.7142E 04	1.0452E 06	19500
20000	5.9594	2.50674	27.0376	29.5443	4.98331	53.7282	58.7095	5.9883E 04	9.9624E 04	1.0744E 06	20000
20500	5.9601	2.50653	27.2765	29.6826	4.98301	54.0029	59.1830	6.1374E 04	1.0192E 05	1.1036E 06	20500
21000	5.9611	2.50633	27.3945	30.0002	4.98271	54.6342	59.6153	7.1694E 04	1.1950E 05	1.3113E 06	21000
21500	5.9621	2.50613	27.4807	30.2003	4.98245	55.0347	60.0129	7.7740E 04	1.2943E 05	1.4300E 06	21500
22000	5.9629	2.50483	27.8807	30.3854	4.97732	55.4034	60.3811	8.3730E 04	1.3937E 05	1.5513E 06	22000
30000	5.9728	2.50451	28.0535	30.9580	4.97948	55.7670	60.7239	8.9692E 04	1.4931E 05	1.6724E 06	30000
32000	5.9745	2.50423	28.2152	30.7194	4.97933	56.0482	61.0455	9.5692E 04	1.5924E 05	1.7942E 06	32000
34000	5.9760	2.50399	28.3670	30.8710	4.97925	56.3498	61.3457	1.0161E 05	1.6910E 05	1.9164E 06	34000
36000	5.9773	2.50377	28.5101	31.0138	4.97918	56.6552	61.6296	1.0750E 05	1.7911E 05	2.0394E 06	36000
38000	5.9785	2.50357	28.6454	31.1490	4.97901	56.9232	61.8983	1.1354E 05	1.8905E 05	2.1631E 06	38000
40000	5.9796	2.50339	28.7739	31.2773	4.97886	57.1704	62.1331	1.1950E 05	1.9899E 05	2.2871E 06	40000
42000	5.9806	2.50323	28.8960	31.3992	4.97874	57.4211	62.3995	1.2544E 05	2.0892E 05	2.4117E 06	42000
44000	5.9814	2.50309	29.0124	31.5155	4.97865	57.6525	62.6266	1.3142E 05	2.1884E 05	2.5367E 06	44000
46000	5.9823	2.50295	29.1237	31.6267	4.97858	57.8736	62.8474	1.3730E 05	2.2879E 05	2.6622E 06	46000
48000	5.9830	2.50283	29.2302	31.7331	4.97854	58.0853	63.0588	1.4335E 05	2.3873E 05	2.7881E 06	48000
50000	5.9837	2.50272	29.3324	31.8351	4.97852	58.2883	63.2616	1.4931E 05	2.4867E 05	2.9144E 06	50000

TABLE 3. IDEAL GAS FUNCTIONS FOR C (ATOMIC WEIGHT 12.0112, R = 1.98717 CAL/MOLE)

BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $N \leq 4$ . SEE TABLE 47 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT}$	$\frac{h^2 - E_0^0}{RT$
---------------	-------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	-------------------------



TABLE 4. IDEAL GAS FUNCTIONS FOR N (ATOMIC WEIGHT 14.0067, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 4B FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2}{8\pi^2 I}$	$\ln \frac{h^2}{8\pi^2 I}$	$\ln \frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I}$	$\ln \frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I}$	$\ln \frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I}$	$\ln \frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I}$	$\ln \frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I}$	TEMP. (°K)		
1000	4.0000	2.50000	18.9500	21.4500	4.96791	37.6548	42.6248	2.9007E 03	4.9679E 03	3.7657E 04	1000
1200	4.0000	2.50000	19.4000	21.9000	4.96791	38.1048	43.0748	2.9007E 03	4.9679E 03	3.7657E 04	1200
1400	4.0000	2.50000	19.7412	22.2412	4.96791	38.5548	43.5248	2.9007E 03	4.9679E 03	3.7657E 04	1400
1600	4.0000	2.50000	20.1250	22.6250	4.96791	38.9991	43.9691	2.9007E 03	4.9679E 03	3.7657E 04	1600
1800	4.0000	2.50001	20.4195	22.9195	4.96793	40.5749	45.5448	2.9007E 03	4.9679E 03	3.7657E 04	1800
2000	4.0000	2.50003	20.6829	23.1829	4.96794	41.1003	46.0693	2.9007E 03	4.9679E 03	3.7657E 04	2000
2200	4.0000	2.50011	20.9212	23.4212	4.96813	41.3736	46.3420	2.9007E 03	4.9681E 03	3.7657E 04	2200
2400	4.0001	2.50028	21.1387	23.6387	4.96848	42.0081	47.0746	2.9007E 03	4.9684E 03	3.7657E 04	2400
2600	4.0002	2.50046	21.3309	23.8309	4.96918	42.4039	47.4722	2.9007E 03	4.9691E 03	3.7657E 04	2600
2800	4.0005	2.50127	21.5242	24.0255	4.97044	42.7722	47.7426	2.9007E 03	4.9704E 03	3.7657E 04	2800
3000	4.0018	2.50230	21.6968	24.1991	4.97248	43.1151	48.0376	2.9007E 03	4.9724E 03	3.7657E 04	3000
3200	4.0030	2.50355	21.8504	24.3622	4.97556	43.4362	48.4117	2.9007E 03	4.9755E 03	3.7657E 04	3200
3400	4.0047	2.50509	22.0102	24.5162	4.97991	43.7379	48.7176	2.9007E 03	4.9799E 03	3.7657E 04	3400
3600	4.0070	2.51201	22.1935	24.6625	4.98579	44.0227	49.0085	2.9007E 03	4.9857E 03	3.7657E 04	3600
3800	4.0101	2.51799	22.4183	24.9359	5.00286	44.5468	49.5517	2.9007E 03	5.0028E 03	3.7657E 04	3800
4000	4.0141	2.52337	22.6413	25.1600	5.01436	44.7932	49.8074	2.9007E 03	5.0143E 03	3.7657E 04	4000
4200	4.0191	2.52822	22.8548	25.3560	5.02794	45.0306	50.0547	2.9007E 03	5.0279E 03	3.7657E 04	4200
4400	4.0252	2.53314	23.0574	25.5586	5.04371	45.2506	50.2943	2.9007E 03	5.0437E 03	3.7657E 04	4400
4600	4.0325	2.53814	23.2497	25.7509	5.06160	45.4637	50.5272	2.9007E 03	5.0616E 03	3.7657E 04	4600
4800	4.0410	2.54321	23.4310	25.9322	5.08159	45.6727	50.7563	2.9007E 03	5.0815E 03	3.7657E 04	4800
5000	4.0518	2.54835	23.5913	26.0925	5.10362	45.8726	51.0760	2.9007E 03	5.1036E 03	3.7657E 04	5000
5200	4.0643	2.55355	23.7415	26.2427	5.12758	46.0645	51.3930	2.9007E 03	5.1275E 03	3.7657E 04	5200
5400	4.0782	2.55932	23.8756	26.3768	5.15336	46.2524	51.6950	2.9007E 03	5.1533E 03	3.7657E 04	5400
5600	4.0995	2.56713	24.0000	26.5000	5.18080	46.4337	51.9845	2.9007E 03	5.1808E 03	3.7657E 04	5600
5800	4.1054	2.57171	24.1154	26.6154	5.20976	46.6098	52.2649	2.9007E 03	5.2097E 03	3.7657E 04	5800
6000	4.1228	2.57636	24.2256	26.7256	5.24007	46.7811	52.5212	2.9007E 03	5.2400E 03	3.7657E 04	6000
6200	4.1418	2.58204	24.3304	26.8304	5.27154	46.9430	52.7695	2.9007E 03	5.2715E 03	3.7657E 04	6200
6400	4.1624	2.58914	24.4304	26.9304	5.30402	47.1107	52.9147	2.9007E 03	5.3040E 03	3.7657E 04	6400
6600	4.1845	2.59709	24.5256	27.0256	5.33731	47.2695	52.9609	2.9007E 03	5.3373E 03	3.7657E 04	6600
6800	4.2081	2.60597	24.6155	27.1155	5.37135	47.4268	52.9982	2.9007E 03	5.3713E 03	3.7657E 04	6800
7000	4.2333	2.61530	24.7009	27.2009	5.40548	47.5825	53.0282	2.9007E 03	5.4054E 03	3.7657E 04	7000
7200	4.2599	2.62517	24.7817	27.2817	5.44042	47.7251	53.1656	2.9007E 03	5.4404E 03	3.7657E 04	7200
7400	4.2880	2.63559	24.8589	27.3589	5.47534	47.8707	53.3049	2.9007E 03	5.4753E 03	3.7657E 04	7400
7600	4.3175	2.64661	24.9317	27.4317	5.51028	48.0134	53.4352	2.9007E 03	5.5102E 03	3.7657E 04	7600
7800	4.3484	2.65824	25.0000	27.5000	5.54511	48.1533	53.5594	2.9007E 03	5.5451E 03	3.7657E 04	7800
8000	4.3807	2.67048	25.0643	27.5643	5.57972	48.2907	53.6704	2.9007E 03	5.5797E 03	3.7657E 04	8000
8200	4.4142	2.68332	25.1256	27.6256	5.61398	48.4255	53.7745	2.9007E 03	5.6139E 03	3.7657E 04	8200
8400	4.4490	2.69674	25.1834	27.6834	5.64782	48.5586	53.8728	2.9007E 03	5.6478E 03	3.7657E 04	8400
8600	4.4850	2.71071	25.2374	27.7374	5.68113	48.6892	53.9657	2.9007E 03	5.6811E 03	3.7657E 04	8600
8800	4.5222	2.72527	25.2874	27.7874	5.71394	48.8163	54.0531	2.9007E 03	5.7139E 03	3.7657E 04	8800
9000	4.5604	2.74040	25.3332	27.8332	5.74599	48.9402	54.1358	2.9007E 03	5.7459E 03	3.7657E 04	9000
9200	4.5998	2.75611	25.3756	27.8756	5.77722	49.0615	54.2132	2.9007E 03	5.7772E 03	3.7657E 04	9200
9400	4.6401	2.77245	25.4144	27.9144	5.80778	49.1801	54.2859	2.9007E 03	5.8077E 03	3.7657E 04	9400
9600	4.6815	2.78943	25.4493	27.9493	5.83755	49.2961	54.3531	2.9007E 03	5.8375E 03	3.7657E 04	9600



TABLE 5. IDEAL GAS FUNCTIONS FOR O (ATOMIC WEIGHT 15.9994, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 49 FOR LIST OF STATES USED.

TEMP. (°K)	PARITY. FUNCT.	$\frac{W^2 - E^2}{RT}$	$\frac{E^2 - E^2}{RT}$	$\frac{E^2 - E^2}{RT}$	$\frac{E^2 - E^2}{RT}$	$\frac{E^2 - E^2}{RT}$	$\frac{E^2 - E^2}{RT}$	$\frac{E^2 - E^2}{RT}$	$\frac{E^2 - E^2}{RT}$	TEMP. (°K)
1000	0.1105	2.59413	19.8544	22.4525	5.15893	19.4560	44.6169	3.1718E 03	5.1589E 03	1000
1200	0.2435	2.58227	20.3285	22.9107	5.13140	40.3960	45.5274	3.7731E 03	4.8475E 03	1200
1400	0.3416	2.57186	20.7257	23.2976	5.11071	41.1894	46.2961	4.3730E 03	7.1550E 03	1400
1600	0.4174	2.56377	21.0486	23.6323	5.09463	41.8667	46.9614	4.9720E 03	8.1514E 03	1600
1800	0.4774	2.55732	21.3702	23.9275	5.08182	42.4660	47.5479	5.5704E 03	9.1672E 03	1800
2000	0.5244	2.55209	21.6393	24.1914	5.07142	43.0009	48.0723	6.1684E 03	1.0163E 04	2000
2200	0.5673	2.54780	21.8823	24.4302	5.06240	43.4938	48.5468	6.7664E 03	1.1130E 04	2200
2400	0.6016	2.54431	22.1039	24.6482	5.05464	43.9451	49.0000	7.3645E 03	1.2134E 04	2400
2600	0.6312	2.54150	22.3074	24.8489	5.04839	44.3285	49.3709	7.9614E 03	1.3131E 04	2600
2800	0.6571	2.53932	22.4957	25.0350	5.04405	44.7024	49.7487	8.5649E 03	1.4129E 04	2800
3000	0.6801	2.53773	22.6708	25.2086	5.04120	45.0507	50.0956	9.1672E 03	1.5129E 04	3000
3200	0.7009	2.53671	22.8346	25.3713	5.03966	45.3761	50.4169	9.7710E 03	1.6131E 04	3200
3400	0.7202	2.53622	22.9885	25.5246	5.03906	45.6816	50.7215	1.0379E 04	1.7134E 04	3400
3600	0.7382	2.53626	23.1333	25.6696	5.03946	45.9697	51.0097	1.0999E 04	1.8142E 04	3600
3800	0.7555	2.53678	23.2704	25.8072	5.04101	46.2422	51.2832	1.1603E 04	1.9155E 04	3800
4000	0.7722	2.53778	23.4006	25.9384	5.04290	46.5000	51.5438	1.2212E 04	2.0172E 04	4000
4200	0.7887	2.53920	23.5244	26.0636	5.04501	46.7469	51.7928	1.2814E 04	2.1192E 04	4200
4400	0.8051	2.54103	23.6426	26.1836	5.04744	46.9818	52.0312	1.3414E 04	2.2216E 04	4400
4600	0.8216	2.54321	23.7556	26.2988	5.05037	47.2063	52.2601	1.4014E 04	2.3247E 04	4600
4800	0.8383	2.54572	23.8639	26.4096	5.05377	47.4215	52.4803	1.4614E 04	2.4282E 04	4800
5000	0.8553	2.54852	23.9679	26.5164	5.05764	47.6281	52.6925	1.5214E 04	2.5322E 04	5000
5200	0.8727	2.55154	24.0679	26.6195	5.06200	47.8269	52.8973	1.5814E 04	2.6364E 04	5200
5400	0.8905	2.55484	24.1642	26.7191	5.06689	48.0183	53.0952	1.6414E 04	2.7415E 04	5400
5600	0.9088	2.55829	24.2572	26.8154	5.07235	48.2031	53.2869	1.7014E 04	2.8469E 04	5600
5800	0.9276	2.56189	24.3471	26.9089	5.07840	48.3816	53.4725	1.7614E 04	2.9527E 04	5800
6000	0.9469	2.56561	24.4340	27.0000	5.08500	48.5543	53.6526	1.8214E 04	3.0590E 04	6000
6200	0.9667	2.56943	24.5182	27.0876	5.09216	48.7214	53.8275	1.8814E 04	3.1654E 04	6200
6400	0.9871	2.57331	24.5998	27.1731	5.10000	48.8839	53.9975	1.9414E 04	3.2727E 04	6400
6600	0.9979	2.57724	24.6790	27.2563	5.10841	49.0413	54.1627	2.0014E 04	3.3807E 04	6600
6800	0.9292	2.58120	24.7560	27.3372	5.11726	49.1943	54.3236	2.0614E 04	3.4892E 04	6800
7000	0.9510	2.58516	24.8309	27.4161	5.12654	49.3431	54.4803	2.1214E 04	3.5982E 04	7000
7200	0.9733	2.58911	24.9036	27.4929	5.13626	49.4880	54.6338	2.1814E 04	3.7077E 04	7200
7400	0.9959	2.59304	24.9748	27.5678	5.14642	49.6296	54.7818	2.2414E 04	3.8177E 04	7400
7600	0.1196	2.59694	25.0440	27.6409	5.15704	49.7686	54.9271	2.3014E 04	3.9282E 04	7600
7800	0.1425	2.60079	25.1115	27.7123	5.16814	49.9007	55.0699	2.3614E 04	4.0392E 04	7800
8000	0.1662	2.60458	25.1774	27.7820	5.17967	50.0316	55.2074	2.4214E 04	4.1506E 04	8000
8200	0.1904	2.60831	25.2418	27.8501	5.19163	50.1599	55.3427	2.4814E 04	4.2624E 04	8200
8400	0.2148	2.61198	25.3044	27.9164	5.20402	50.2845	55.4759	2.5414E 04	4.3746E 04	8400
8600	0.2395	2.61557	25.3642	27.9817	5.21684	50.4047	55.6063	2.6014E 04	4.4872E 04	8600
8800	0.2645	2.61909	25.4233	28.0454	5.23015	50.5203	55.7349	2.6614E 04	4.5999E 04	8800
9000	0.2896	2.62252	25.4812	28.1077	5.24396	50.6316	55.8617	2.7214E 04	4.7130E 04	9000
9200	0.3150	2.62588	25.5379	28.1688	5.25826	50.7388	55.9867	2.7814E 04	4.8264E 04	9200
9400	0.3406	2.62916	25.5934	28.2286	5.27304	50.8423	56.1098	2.8414E 04	4.9402E 04	9400
9600	0.3664	2.63236	25.6478	28.2871	5.28831	50.9423	56.2303	2.9014E 04	5.0544E 04	9600
9800	0.3923	2.63547	25.7001	28.3446	5.30406	51.0392	56.3484	2.9614E 04	5.1690E 04	9800





TABLE 4. TOTAL GAS PARTICLES PER Å<sup>3</sup> (ATOMIC WEIGHT 39.9400,  $R = 1.08717$  CAL/MOLE) BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 6$ . SEE TABLE 50 FOR LIST OF STATES USED.

[illegible]

TABLE 6 (CONT.). IDEAL GAS FUNCTIONS FOR AIR

[illegible]

TABLE 7. IDEAL GAS FUNCTIONS FOR C+ (ATOMIC WEIGHT 12.0108,  $R = 1.98717$  CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 51 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{W - E}{RT}$	$-\frac{E - E_0}{RT}$	$\ln \frac{W - E}{RT}$	$-\ln \frac{E - E_0}{RT}$	$\ln \frac{W - E}{RT} - \ln \frac{E - E_0}{RT}$	$\frac{E - E_0}{RT}$	$\frac{W - E}{RT}$	$-\ln \frac{E - E_0}{RT}$	$\ln \frac{W - E}{RT}$	$-\ln \frac{E - E_0}{RT}$	TEMP. (°K)
1000	5.4481	2.59048	19.0644	21.6239	5.06410	37.0642	42.9793	3.00000	3.00000	3.00000	3.00000	1000
1200	5.4705	2.54083	19.5362	22.0800	5.06404	38.0764	43.8764	3.00000	3.00000	3.00000	3.00000	1200
1400	5.4934	2.50280	19.9227	22.4456	5.06397	38.9897	44.7456	3.00000	3.00000	3.00000	3.00000	1400
1600	5.5163	2.47362	20.2619	22.7495	5.06390	39.8464	45.5964	3.00000	3.00000	3.00000	3.00000	1600
1800	5.5395	2.45132	20.5605	23.0045	5.06382	40.6517	46.4317	3.00000	3.00000	3.00000	3.00000	1800
2000	5.5630	2.43422	20.8273	23.2175	5.06374	41.4073	47.2517	3.00000	3.00000	3.00000	3.00000	2000
2200	5.5868	2.42075	21.0643	23.3958	5.06366	42.1134	48.0568	3.00000	3.00000	3.00000	3.00000	2200
2400	5.6110	2.40945	21.2701	23.5434	5.06357	42.7701	48.8364	3.00000	3.00000	3.00000	3.00000	2400
2600	5.6356	2.40000	21.4492	23.6655	5.06348	43.3876	49.5865	3.00000	3.00000	3.00000	3.00000	2600
2800	5.6606	2.39224	21.6071	23.7666	5.06338	43.9541	50.3071	3.00000	3.00000	3.00000	3.00000	2800
3000	5.6860	2.38600	21.7481	23.8500	5.06328	44.4766	50.9900	3.00000	3.00000	3.00000	3.00000	3000
3200	5.7118	2.38100	21.8766	23.9181	5.06317	44.9551	51.6366	3.00000	3.00000	3.00000	3.00000	3200
3400	5.7380	2.37700	21.9966	23.9741	5.06306	45.3906	52.2466	3.00000	3.00000	3.00000	3.00000	3400
3600	5.7646	2.37380	22.1100	24.0200	5.06294	45.7831	52.8200	3.00000	3.00000	3.00000	3.00000	3600
3800	5.7916	2.37130	22.2181	24.0571	5.06282	46.1366	53.3581	3.00000	3.00000	3.00000	3.00000	3800
4000	5.8190	2.36940	22.3216	24.0866	5.06270	46.4531	53.8616	3.00000	3.00000	3.00000	3.00000	4000
4200	5.8468	2.36800	22.4206	24.1100	5.06258	46.7336	54.3316	3.00000	3.00000	3.00000	3.00000	4200
4400	5.8750	2.36700	22.5151	24.1281	5.06246	46.9791	54.7681	3.00000	3.00000	3.00000	3.00000	4400
4600	5.9036	2.36630	22.6066	24.1421	5.06234	47.1906	55.1726	3.00000	3.00000	3.00000	3.00000	4600
4800	5.9326	2.36590	22.6951	24.1531	5.06222	47.3691	55.5451	3.00000	3.00000	3.00000	3.00000	4800
5000	5.9620	2.36570	22.7806	24.1616	5.06210	47.5156	55.8866	3.00000	3.00000	3.00000	3.00000	5000
5200	5.9918	2.36560	22.8631	24.1681	5.06200	47.6311	56.1981	3.00000	3.00000	3.00000	3.00000	5200
5400	6.0220	2.36560	22.9426	24.1731	5.06190	47.7166	56.4816	3.00000	3.00000	3.00000	3.00000	5400
5600	6.0526	2.36560	23.0191	24.1771	5.06180	47.7731	56.7381	3.00000	3.00000	3.00000	3.00000	5600
5800	6.0836	2.36560	23.0926	24.1801	5.06170	47.8016	56.9686	3.00000	3.00000	3.00000	3.00000	5800
6000	6.1150	2.36560	23.1641	24.1826	5.06160	47.8131	57.1741	3.00000	3.00000	3.00000	3.00000	6000
6200	6.1468	2.36560	23.2336	24.1846	5.06150	47.8186	57.3566	3.00000	3.00000	3.00000	3.00000	6200
6400	6.1790	2.36560	23.3011	24.1861	5.06140	47.8181	57.5181	3.00000	3.00000	3.00000	3.00000	6400
6600	6.2116	2.36560	23.3666	24.1871	5.06130	47.8126	57.6586	3.00000	3.00000	3.00000	3.00000	6600
6800	6.2446	2.36560	23.4301	24.1876	5.06120	47.8031	57.7791	3.00000	3.00000	3.00000	3.00000	6800
7000	6.2780	2.36560	23.4916	24.1876	5.06110	47.7896	57.8806	3.00000	3.00000	3.00000	3.00000	7000
7200	6.3118	2.36560	23.5501	24.1871	5.06100	47.7721	57.9641	3.00000	3.00000	3.00000	3.00000	7200
7400	6.3460	2.36560	23.6066	24.1861	5.06090	47.7506	58.0306	3.00000	3.00000	3.00000	3.00000	7400
7600	6.3806	2.36560	23.6611	24.1846	5.06080	47.7251	58.0801	3.00000	3.00000	3.00000	3.00000	7600
7800	6.4156	2.36560	23.7136	24.1826	5.06070	47.6956	58.1146	3.00000	3.00000	3.00000	3.00000	7800
8000	6.4510	2.36560	23.7641	24.1801	5.06060	47.6621	58.1341	3.00000	3.00000	3.00000	3.00000	8000
8200	6.4868	2.36560	23.8126	24.1771	5.06050	47.6256	58.1406	3.00000	3.00000	3.00000	3.00000	8200
8400	6.5230	2.36560	23.8591	24.1736	5.06040	47.5861	58.1341	3.00000	3.00000	3.00000	3.00000	8400
8600	6.5596	2.36560	23.9036	24.1696	5.06030	47.5436	58.1146	3.00000	3.00000	3.00000	3.00000	8600
8800	6.5966	2.36560	23.9461	24.1651	5.06020	47.4981	58.0801	3.00000	3.00000	3.00000	3.00000	8800
9000	6.6340	2.36560	23.9866	24.1601	5.06010	47.4496	58.0306	3.00000	3.00000	3.00000	3.00000	9000
9200	6.6718	2.36560	24.0251	24.1546	5.06000	47.3981	57.9681	3.00000	3.00000	3.00000	3.00000	9200
9400	6.7100	2.36560	24.0616	24.1486	5.05990	47.3436	57.8936	3.00000	3.00000	3.00000	3.00000	9400
9600	6.7486	2.36560	24.0961	24.1421	5.05980	47.2861	57.8081	3.00000	3.00000	3.00000	3.00000	9600
9800	6.7876	2.36560	24.1286	24.1351	5.05970	47.2256	57.7136	3.00000	3.00000	3.00000	3.00000	9800
10000	6.8270	2.36560	24.1601	24.1276	5.05960	47.1621	57.6101	3.00000	3.00000	3.00000	3.00000	10000

TABLE 7 (CONT.). IDEAL GAS FUNCTIONS FOR C<sub>2</sub>

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2 - \epsilon^2}{RT}$	$\ln \frac{h^2 - \epsilon^2}{RT}$	$\ln \frac{h^2 - \epsilon^2}{RT} - \ln \frac{h^2 - \epsilon^2}{RT}$	$\ln \frac{h^2 - \epsilon^2}{RT}$	$\ln \frac{h^2 - \epsilon^2}{RT}$	$\ln \frac{h^2 - \epsilon^2}{RT}$	$\ln \frac{h^2 - \epsilon^2}{RT}$	$\ln \frac{h^2 - \epsilon^2}{RT}$	TEMP. (°K)
1000	9.9681	2.93107	9.09124	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	10000
1050	9.9984	2.93883	9.09570	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	10500
11000	9.9984	2.94483	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	11000
11500	9.9984	2.95386	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	11500
12000	9.9984	2.96586	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	12000
12500	9.9984	2.97678	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	12500
13000	9.9984	2.98695	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	13000
13500	9.9984	2.99640	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	13500
14000	9.9984	3.00510	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	14000
14500	9.9984	3.01316	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	14500
15000	9.9984	3.02056	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	15000
15500	9.9984	3.02721	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	15500
16000	9.9984	3.03316	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	16000
16500	9.9984	3.03836	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	16500
17000	9.9984	3.04286	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	17000
17500	9.9984	3.04664	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	17500
18000	9.9984	3.04964	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	18000
18500	9.9984	3.05189	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	18500
19000	9.9984	3.05336	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	19000
19500	9.9984	3.05402	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	19500
20000	9.9984	3.05386	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	20000
20500	9.9984	3.05286	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	20500
21000	9.9984	3.05095	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	21000
21500	9.9984	3.04712	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	21500
22000	9.9984	3.04133	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	22000
22500	9.9984	3.03357	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	22500
23000	9.9984	3.02310	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	23000
23500	9.9984	3.00982	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	23500
24000	9.9984	2.99305	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	24000
24500	9.9984	2.97228	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	24500
25000	9.9984	2.94702	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	25000
25500	9.9984	2.91683	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	25500
26000	9.9984	2.88101	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	26000
26500	9.9984	2.83905	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	26500
27000	9.9984	2.79051	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	27000
27500	9.9984	2.73483	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	27500
28000	9.9984	2.67151	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	28000
28500	9.9984	2.59905	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	28500
29000	9.9984	2.51683	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	29000
29500	9.9984	2.42336	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	29500
30000	9.9984	2.31805	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	30000
30500	9.9984	2.19905	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	30500
31000	9.9984	2.06483	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	31000
31500	9.9984	1.91483	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	31500
32000	9.9984	1.74805	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	32000
32500	9.9984	1.56305	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	32500
33000	9.9984	1.35805	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	33000
33500	9.9984	1.13205	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	33500
34000	9.9984	0.88405	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	34000
34500	9.9984	0.61305	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	34500
35000	9.9984	0.32805	9.09998	46.4986	94.4986	1.0441E 04	5.0312E 04	5.0312E 04	5.0312E 04	35000

TABLE 8. INTERNAL GAS FUNCTIONS FOR  $H_2$  (GASEOUS PHASE) 14.0042,  $R = 1.98717$  CAL/MOLE) BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 52 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{U^0 - E^0}{RT}$	$-\frac{U^0 - E^0}{RT}$	$\Delta H$	$\ln^0 - \frac{E^0 - U^0}{RT} - \frac{10^6 - E^0 - U^0}{CAL/MOLE} \%$	$\delta^0$	$E^0 - E^0$	$-\frac{10^6 - E^0}{CAL/MOLE}$	$-\frac{10^6 - E^0}{CAL/MOLE}$	TEMP. (°K)		
1000	7.9993	2.62287	19.6355	22.2504	9.21209	39.0190	44.2311	3.22496	03	5.2121E 02	3.9019E 04	1800
1200	8.1041	2.60310	20.1113	22.7150	9.17280	40.9458	45.1384	3.8228E 03	03	6.2074E 03	4.7991E 04	1200
1400	8.2244	2.58081	20.5120	23.1608	9.14439	42.7607	45.9951	4.4201E 03	03	7.2021E 03	5.7045E 04	1400
1600	8.3164	2.57000	20.8549	23.4349	9.12291	41.4442	46.5691	5.0172E 03	03	8.1964E 03	6.6314E 04	1600
1800	8.3891	2.56955	21.1401	23.7294	9.10613	41.0066	47.1347	5.6141E 03	03	9.1910E 03	7.5407E 04	1800
2000	8.4478	2.56281	21.4305	23.9923	9.09273	42.5859	47.6786	6.2111E 03	03	1.0185E 04	8.5172E 04	2000
2200	8.4963	2.55737	21.6795	24.2318	9.08192	43.0707	48.1324	6.8085E 03	03	1.1180E 04	9.4704E 04	2200
2400	8.5371	2.55298	21.8968	24.4498	9.07319	43.5125	48.5857	7.4062E 03	03	1.2174E 04	1.0443E 05	2400
2600	8.5721	2.54948	22.1010	24.6485	9.06624	43.9185	49.0485	8.0034E 03	03	1.3172E 04	1.1418E 05	2600
2800	8.6028	2.54678	22.2892	24.8366	9.06088	44.2935	49.5144	8.6004E 03	03	1.4170E 04	1.2402E 05	2800
3000	8.6299	2.54481	22.4655	25.0103	9.05697	44.6426	49.9895	9.2044E 03	03	1.5171E 04	1.3392E 05	3000
3200	8.6546	2.54353	22.6296	25.1732	9.05441	44.9688	50.4723	9.8122E 03	03	1.6174E 04	1.4390E 05	3200
3400	8.6772	2.54268	22.7838	25.3267	9.05312	45.2752	50.9617	1.0424E 04	04	1.7181E 04	1.5394E 05	3400
3600	8.6985	2.54203	22.9292	25.4720	9.05303	45.5640	51.4571	1.1037E 04	04	1.8191E 04	1.6409E 05	3600
3800	8.7188	2.54334	23.0667	25.6100	9.05404	45.8373	51.9513	1.1654E 04	04	1.9203E 04	1.7418E 05	3800
4000	8.7384	2.54537	23.1971	25.7415	9.05608	46.0966	52.4526	1.2276E 04	04	2.0224E 04	1.8439E 05	4000
4200	8.7576	2.54587	23.3213	25.8672	9.05906	46.3433	52.9616	1.2902E 04	04	2.1248E 04	1.9464E 05	4200
4400	8.7767	2.54780	23.4398	25.9876	9.06290	46.5787	53.4780	1.3533E 04	04	2.2277E 04	2.0494E 05	4400
4600	8.7958	2.55011	23.5531	26.1032	9.06749	46.8039	53.9914	1.4170E 04	04	2.3310E 04	2.1530E 05	4600
4800	8.8151	2.55276	23.6617	26.2144	9.07276	47.0197	54.5024	1.4811E 04	04	2.4349E 04	2.2569E 05	4800
5000	8.8346	2.55571	23.7640	26.3217	9.07861	47.2269	55.0112	1.5457E 04	04	2.5393E 04	2.3613E 05	5000
5200	8.8545	2.5591	23.8643	26.4252	9.08497	47.4262	55.5182	1.6109E 04	04	2.6442E 04	2.4662E 05	5200
5400	8.8747	2.56332	23.9629	26.5252	9.09176	47.6183	56.0230	1.6765E 04	04	2.7496E 04	2.5714E 05	5400
5600	8.8954	2.56831	24.0591	26.6221	9.09890	47.8035	56.5264	1.7424E 04	04	2.8554E 04	2.6770E 05	5600
5800	8.9166	2.56965	24.1462	26.7159	9.10632	47.9826	57.0289	1.8081E 04	04	2.9617E 04	2.7830E 05	5800
6000	8.9383	2.57351	24.2334	26.8069	9.11390	48.1558	57.5300	1.8741E 04	04	3.0684E 04	2.8893E 05	6000
6200	8.9604	2.57745	24.3179	26.8953	9.12181	48.3236	58.0344	1.9403E 04	04	3.1752E 04	2.9961E 05	6200
6400	8.9830	2.58145	24.3998	26.9812	9.12977	48.4864	58.5361	2.0113E 04	04	3.2831E 04	3.1031E 05	6400
6600	9.0061	2.58549	24.4793	27.0648	9.13780	48.6443	59.0371	2.0794E 04	04	3.3910E 04	3.2102E 05	6600
6800	9.0297	2.58956	24.5565	27.1461	9.14588	48.7978	59.5377	2.1479E 04	04	3.4992E 04	3.3183E 05	6800
7000	9.0537	2.59363	24.6316	27.2253	9.15390	48.9471	60.0371	2.2168E 04	04	3.6078E 04	3.4263E 05	7000
7200	9.0781	2.59770	24.7048	27.3024	9.16205	49.0924	60.5345	2.2859E 04	04	3.7167E 04	3.5347E 05	7200
7400	9.1030	2.60174	24.7760	27.3777	9.17036	49.2346	61.0301	2.3554E 04	04	3.8259E 04	3.6433E 05	7400
7600	9.1282	2.60575	24.8454	27.4512	9.17880	49.3720	61.5240	2.4251E 04	04	3.9353E 04	3.7523E 05	7600
7800	9.1538	2.60972	24.9132	27.5229	9.18734	49.5066	62.0165	2.4950E 04	04	4.0450E 04	3.8615E 05	7800
8000	9.1797	2.61364	24.9793	27.5929	9.19594	49.6380	62.5077	2.5653E 04	04	4.1550E 04	3.9710E 05	8000
8200	9.2059	2.61751	25.0439	27.6614	9.20462	49.7663	63.0000	2.6359E 04	04	4.2652E 04	4.0808E 05	8200
8400	9.2324	2.62132	25.1070	27.7283	9.21339	49.8917	63.4944	2.7068E 04	04	4.3754E 04	4.1909E 05	8400
8600	9.2592	2.62507	25.1687	27.7938	9.22227	50.0144	63.9900	2.7772E 04	04	4.4861E 04	4.3012E 05	8600
8800	9.2863	2.62876	25.2291	27.8579	9.23117	50.1344	64.4865	2.8482E 04	04	4.5969E 04	4.4118E 05	8800
9000	9.3136	2.63238	25.2882	27.9206	9.24009	50.2519	64.9849	2.9194E 04	04	4.7078E 04	4.5227E 05	9000
9200	9.3411	2.63593	25.3461	27.9820	9.24903	50.3669	65.4849	2.9908E 04	04	4.8188E 04	4.6338E 05	9200
9400	9.3688	2.63941	25.4028	28.0423	9.25799	50.4796	65.9864	3.0623E 04	04	4.9299E 04	4.7451E 05	9400
9600	9.3967	2.64283	25.4584	28.1013	9.26697	50.5901	66.4889	3.1338E 04	04	5.0411E 04	4.8565E 05	9600
9800	9.4247	2.64617	25.5130	28.1591	9.27596	50.6985	66.9924	3.2053E 04	04	5.1524E 04	4.9680E 05	9800

TABLE 8 (CONT.). IDEAL GAS FUNCTIONS FOR N<sub>2</sub>

TEMP. (°K)	PARTIAL FUNCT.	$\frac{h^2 - c}{RT}$	$\frac{h^2 - c}{RT}$	$\frac{h^2 - c}{RT}$	$\frac{h^2 - c}{RT}$	$\frac{h^2 - c}{RT}$	$\frac{h^2 - c}{RT}$	$\frac{h^2 - c}{RT}$	$\frac{h^2 - c}{RT}$	$\frac{h^2 - c}{RT}$	$\frac{h^2 - c}{RT}$	TEMP. (°K)
10000	9.4529	2.64945	25.5465	28.2159	5.26490	50.8040	56.0497	3.27778	04	5.26490	04	10000
10500	9.5239	2.63734	25.4899	28.3533	5.28062	51.0621	56.2627	3.45818	04	5.54478	04	10500
11000	9.5956	2.62487	25.4337	28.4864	5.29854	51.3093	56.4836	3.63828	04	5.82918	04	11000
11500	9.6677	2.61201	25.3783	28.6193	5.31873	51.5438	56.7208	3.82096	04	6.10828	04	11500
12000	9.7401	2.60080	25.3232	28.7510	5.34022	51.7760	57.0953	4.00338	04	6.38798	04	12000
12500	9.8128	2.68528	26.1617	28.8870	5.36609	51.9876	57.5237	4.18628	04	6.67018	04	12500
13000	9.8855	2.69147	26.2671	28.9586	5.38839	52.1971	57.9955	4.36962	04	6.95298	04	13000
13500	9.9583	2.69740	26.3468	29.0462	5.40817	52.3992	58.4659	4.55346	04	7.23528	04	13500
14000	10.0311	2.70310	26.4470	29.1701	5.42911	52.5943	58.9359	4.73818	04	7.52018	04	14000
14500	10.1039	2.70860	26.5620	29.2706	5.45244	52.7830	59.4055	4.92318	04	7.80458	04	14500
15000	10.1765	2.71393	26.6839	29.3678	5.47802	52.9657	59.8740	5.10838	04	8.08958	04	15000
15500	10.2490	2.71911	26.7430	29.4621	5.49331	53.1427	60.3427	5.29502	04	8.37518	04	15500
16000	10.3214	2.72416	26.8294	29.5535	5.51135	53.3144	60.8113	5.48198	04	8.66148	04	16000
16500	10.3936	2.72911	26.9133	29.6424	5.53180	53.4811	61.2800	5.66948	04	8.94838	04	16500
17000	10.4657	2.73397	26.9948	29.7288	5.55485	53.6432	61.7487	5.85778	04	9.23598	04	17000
17500	10.5376	2.73878	27.0741	29.8129	5.58040	53.8008	62.2174	6.04678	04	9.52328	04	17500
18000	10.6095	2.74354	27.1514	29.8949	5.60817	53.9542	62.6861	6.23658	04	9.81138	04	18000
18500	10.6812	2.74828	27.2284	29.9749	5.63829	54.1037	63.1548	6.42718	04	1.01038	04	18500
19000	10.7528	2.75301	27.3051	30.0530	5.67065	54.2495	63.6235	6.61878	04	1.03948	04	19000
19500	10.8244	2.75776	27.3715	30.1293	5.70512	54.3917	64.0922	6.81138	04	1.06868	05	19500
20000	10.8959	2.76253	27.4414	30.2039	5.74260	54.5306	64.5609	7.00498	04	1.09798	05	20000
20500	11.0222	2.76828	27.5056	30.2758	5.78260	54.6654	65.0296	7.19938	04	1.21638	05	20500
21000	11.1475	2.80351	27.5646	30.3451	5.82510	54.7962	65.4983	7.39378	04	1.33178	05	21000
21500	11.2734	2.82743	28.1739	31.0014	5.87018	54.9236	65.9670	7.58818	04	1.44608	05	21500
22000	12.0642	2.85495	28.3044	31.2394	5.91732	55.0466	66.4357	7.78258	04	1.55988	05	22000
22500	12.3764	2.88709	28.5825	31.4496	5.96713	55.1651	66.9044	7.97698	04	1.72318	05	22500
23000	12.7044	2.92489	28.7700	31.6499	6.01924	55.2794	67.3731	8.17138	04	1.85998	05	23000
23500	13.0529	2.96933	28.9484	31.9179	6.07356	55.3896	67.8418	8.36578	04	2.00428	05	23500
24000	13.4270	3.02125	29.1197	32.1410	6.13007	55.4957	68.3105	8.56018	04	2.16138	05	24000
24500	13.8325	3.08131	29.2847	32.3660	6.18873	55.5978	68.7792	8.75458	04	2.32668	05	24500
25000	14.2735	3.14986	29.4444	32.5943	6.25028	55.6959	69.2479	8.94898	04	2.50378	05	25000
25500	14.7424	3.22693	29.5999	32.8269	6.31465	55.7890	69.7166	9.14338	04	2.69328	05	25500
26000	15.2497	3.31222	29.7570	33.0642	6.38184	55.8771	70.1853	9.33778	04	2.89038	05	26000
26500	15.7943	3.40592	29.9012	33.3063	6.45184	55.9602	70.6540	9.53218	04	3.11248	05	26500
27000	16.3758	3.50945	30.0482	33.5525	6.52457	56.0383	71.1227	9.72658	04	3.34658	05	27000
27500	16.9951	3.60891	30.1934	33.8023	6.60002	56.1124	71.5914	9.92098	04	3.58578	05	27500

TABLE 9. IDEAL GAS FUNCTIONS FOR DIATOMIC GASES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 33 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	TEMP. (°K)
1000	4.0000	2.50000	16.1499	21.0049	4.90791	30.0932	43.0211	2.90076	03	4.90791	1000
1200	4.0000	2.50000	19.0653	22.1053	4.90791	34.9900	45.9249	3.57092	03	4.90791	1200
1400	4.0000	2.50000	19.9907	22.4407	4.90791	39.7248	44.0247	4.17306	03	4.90791	1400
1600	4.0000	2.50000	20.3245	22.8245	4.90791	40.3062	45.3501	4.70478	03	4.90791	1600
1800	4.0000	2.50000	20.6190	23.1190	4.90791	40.9733	45.9412	5.18428	03	4.90791	1800
2000	4.0000	2.50000	20.8824	23.3824	4.90791	41.6971	46.6444	5.61156	03	4.90791	2000
2200	4.0000	2.50000	21.1204	23.6204	4.90791	42.4702	47.3700	6.00000	03	4.90791	2200
2400	4.0000	2.50000	21.3362	23.8362	4.90791	43.2925	48.0925	6.35000	03	4.90791	2400
2600	4.0000	2.50000	21.5303	24.0303	4.90791	44.0650	48.8150	6.67000	03	4.90791	2600
2800	4.0000	2.50000	21.7235	24.2235	4.90791	44.7976	49.5476	6.96000	03	4.90791	2800
3000	4.0000	2.50000	21.9167	24.4167	4.90791	45.4902	50.2402	7.22000	03	4.90791	3000
3200	4.0000	2.50000	22.1099	24.6099	4.90791	46.1428	50.8928	7.46000	03	4.90791	3200
3400	4.0000	2.50000	22.2931	24.7931	4.90791	46.7554	51.5054	7.68000	03	4.90791	3400
3600	4.0000	2.50000	22.4763	24.9763	4.90791	47.3280	52.0780	7.89000	03	4.90791	3600
3800	4.0000	2.50000	22.6595	25.1595	4.90791	47.8606	52.6106	8.09000	03	4.90791	3800
4000	4.0000	2.50000	22.8427	25.3427	4.90791	48.3532	53.1032	8.28000	03	4.90791	4000
4200	4.0000	2.50000	23.0259	25.5259	4.90791	48.8058	53.5558	8.46000	03	4.90791	4200
4400	4.0000	2.50000	23.2091	25.7091	4.90791	49.2184	53.9684	8.63000	03	4.90791	4400
4600	4.0000	2.50000	23.3923	25.8923	4.90791	49.5910	54.3410	8.79000	03	4.90791	4600
4800	4.0000	2.50000	23.5755	26.0755	4.90791	49.9236	54.6736	8.94000	03	4.90791	4800
5000	4.0000	2.50000	23.7587	26.2587	4.90791	50.2162	54.9662	9.08000	03	4.90791	5000
5200	4.0000	2.50000	23.9419	26.4419	4.90791	50.4688	55.2188	9.21000	03	4.90791	5200
5400	4.0000	2.50000	24.1251	26.6251	4.90791	50.6814	55.4314	9.33000	03	4.90791	5400
5600	4.0000	2.50000	24.3083	26.8083	4.90791	50.8540	55.6040	9.44000	03	4.90791	5600
5800	4.0000	2.50000	24.4915	26.9915	4.90791	51.0066	55.7566	9.54000	03	4.90791	5800
6000	4.0000	2.50000	24.6747	27.1747	4.90791	51.1392	55.8892	9.63000	03	4.90791	6000
6200	4.0000	2.50000	24.8579	27.3579	4.90791	51.2518	55.9918	9.71000	03	4.90791	6200
6400	4.0000	2.50000	25.0411	27.5411	4.90791	51.3444	56.0744	9.78000	03	4.90791	6400
6600	4.0000	2.50000	25.2243	27.7243	4.90791	51.4270	56.1470	9.84000	03	4.90791	6600
6800	4.0000	2.50000	25.4075	27.9075	4.90791	51.4996	56.2096	9.89000	03	4.90791	6800
7000	4.0000	2.50000	25.5907	28.0907	4.90791	51.5622	56.2722	9.93000	03	4.90791	7000
7200	4.0000	2.50000	25.7739	28.2739	4.90791	51.6148	56.3248	9.96000	03	4.90791	7200
7400	4.0000	2.50000	25.9571	28.4571	4.90791	51.6674	56.3774	9.98000	03	4.90791	7400
7600	4.0000	2.50000	26.1403	28.6403	4.90791	51.7100	56.4200	9.99000	03	4.90791	7600
7800	4.0000	2.50000	26.3235	28.8235	4.90791	51.7526	56.4626	10.00000	03	4.90791	7800
8000	4.0000	2.50000	26.5067	29.0067	4.90791	51.7952	56.5052	10.00000	03	4.90791	8000
8200	4.0000	2.50000	26.6899	29.1899	4.90791	51.8378	56.5478	10.00000	03	4.90791	8200
8400	4.0000	2.50000	26.8731	29.3731	4.90791	51.8804	56.5904	10.00000	03	4.90791	8400
8600	4.0000	2.50000	27.0563	29.5563	4.90791	51.9230	56.6330	10.00000	03	4.90791	8600
8800	4.0000	2.50000	27.2395	29.7395	4.90791	51.9656	56.6756	10.00000	03	4.90791	8800
9000	4.0000	2.50000	27.4227	29.9227	4.90791	52.0082	56.7182	10.00000	03	4.90791	9000
9200	4.0000	2.50000	27.6059	30.1059	4.90791	52.0508	56.7608	10.00000	03	4.90791	9200
9400	4.0000	2.50000	27.7891	30.2891	4.90791	52.0934	56.8034	10.00000	03	4.90791	9400
9600	4.0000	2.50000	27.9723	30.4723	4.90791	52.1360	56.8460	10.00000	03	4.90791	9600
9800	4.0000	2.50000	28.1555	30.6555	4.90791	52.1786	56.8886	10.00000	03	4.90791	9800
10000	4.0000	2.50000	28.3387	30.8387	4.90791	52.2212	56.9312	10.00000	03	4.90791	10000



TABLE 9 (CONT.). IDEAL GAS HEAT CAPACITIES PER MO.

TEMP. (°K.)	PAOIT. FUNK.	$\frac{U^0 - U^0}{T}$	$\frac{U^0 - U^0}{T}$	$\frac{U^0 - U^0}{T}$	$\frac{U^0 - U^0}{T}$	$\frac{U^0 - U^0}{T}$	$\frac{U^0 - U^0}{T}$	$\frac{U^0 - U^0}{T}$	$\frac{U^0 - U^0}{T}$	TEMP. (°K.)
10000	4.2207	2.71606	24.9616	5.39904	99.0000	3.61196	5.39904	3.61196	5.39904	10000
10500	4.2769	2.74522	25.0949	5.44116	99.0077	3.61176	5.44116	3.61176	5.44116	10500
11000	4.3296	2.77960	25.2235	5.48031	99.0122	3.61156	5.48031	3.61156	5.48031	11000
11500	4.3809	2.81073	25.3471	5.51695	99.0171	3.61136	5.51695	3.61136	5.51695	11500
12000	4.4402	2.84127	25.4660	5.55097	99.0222	3.61116	5.55097	3.61116	5.55097	12000
12500	4.5133	2.87095	25.5806	5.58266	99.0275	3.61096	5.58266	3.61096	5.58266	12500
13000	4.5921	2.90094	25.6917	5.61211	99.0331	3.61076	5.61211	3.61076	5.61211	13000
13500	4.6761	2.93129	25.8000	5.64031	99.0389	3.61056	5.64031	3.61056	5.64031	13500
14000	4.7657	2.96207	25.9066	5.66736	99.0449	3.61036	5.66736	3.61036	5.66736	14000
14500	4.8613	3.00330	26.0116	5.69326	99.0511	3.61016	5.69326	3.61016	5.69326	14500
15000	4.9633	3.04507	26.1160	5.71801	99.0575	3.60996	5.71801	3.60996	5.71801	15000
15500	5.0721	3.08838	26.2199	5.74161	99.0641	3.60976	5.74161	3.60976	5.74161	15500
16000	5.1881	3.13325	26.3234	5.76406	99.0709	3.60956	5.76406	3.60956	5.76406	16000
16500	5.3118	3.17978	26.4265	5.78536	99.0779	3.60936	5.78536	3.60936	5.78536	16500
17000	5.4437	3.22806	26.5292	5.80551	99.0851	3.60916	5.80551	3.60916	5.80551	17000
17500	5.5844	3.27819	26.6316	5.82451	99.0925	3.60896	5.82451	3.60896	5.82451	17500
18000	5.7344	3.33016	26.7337	5.84236	99.1001	3.60876	5.84236	3.60876	5.84236	18000
18500	5.8944	3.38397	26.8355	5.85906	99.1079	3.60856	5.85906	3.60856	5.85906	18500
19000	6.0651	3.43964	26.9370	5.87461	99.1159	3.60836	5.87461	3.60836	5.87461	19000
19500	6.2471	3.49717	27.0382	5.88901	99.1241	3.60816	5.88901	3.60816	5.88901	19500
20000	6.4411	3.55656	27.1392	5.90226	99.1325	3.60796	5.90226	3.60796	5.90226	20000
20500	6.6479	3.61781	27.2400	5.91546	99.1411	3.60776	5.91546	3.60776	5.91546	20500
21000	6.8671	3.68092	27.3406	5.92861	99.1499	3.60756	5.92861	3.60756	5.92861	21000
21500	7.0994	3.74589	27.4410	5.94171	99.1589	3.60736	5.94171	3.60736	5.94171	21500
22000	7.3457	3.81272	27.5413	5.95476	99.1681	3.60716	5.95476	3.60716	5.95476	22000
22500	7.6067	3.88141	27.6415	5.96776	99.1775	3.60696	5.96776	3.60696	5.96776	22500
23000	7.8831	3.95196	27.7416	5.98071	99.1871	3.60676	5.98071	3.60676	5.98071	23000
23500	8.1757	4.02437	27.8416	5.99361	99.1969	3.60656	5.99361	3.60656	5.99361	23500
24000	8.4853	4.09864	27.9415	6.00646	99.2069	3.60636	6.00646	3.60636	6.00646	24000
24500	8.8027	4.17477	28.0413	6.01926	99.2171	3.60616	6.01926	3.60616	6.01926	24500
25000	9.1279	4.25276	28.1410	6.03201	99.2275	3.60596	6.03201	3.60596	6.03201	25000
25500	9.4607	4.33261	28.2406	6.04471	99.2381	3.60576	6.04471	3.60576	6.04471	25500
26000	9.8019	4.41432	28.3400	6.05736	99.2489	3.60556	6.05736	3.60556	6.05736	26000
26500	10.1513	4.49789	28.4393	6.07001	99.2599	3.60536	6.07001	3.60536	6.07001	26500
27000	10.5091	4.58332	28.5385	6.08261	99.2711	3.60516	6.08261	3.60516	6.08261	27000
27500	10.8753	4.67061	28.6376	6.09516	99.2825	3.60496	6.09516	3.60496	6.09516	27500
28000	11.2501	4.75976	28.7366	6.10766	99.2941	3.60476	6.10766	3.60476	6.10766	28000
28500	11.6335	4.85077	28.8355	6.12011	99.3059	3.60456	6.12011	3.60456	6.12011	28500
29000	12.0257	4.94364	28.9343	6.13251	99.3179	3.60436	6.13251	3.60436	6.13251	29000
29500	12.4267	5.03837	29.0330	6.14486	99.3299	3.60416	6.14486	3.60416	6.14486	29500
30000	12.8367	5.13496	29.1316	6.15716	99.3421	3.60396	6.15716	3.60396	6.15716	30000

TABLE 10. IDEAL GAS FUNCTIONS FOR AR\* (ATOMIC WEIGHT 39.9470, R = 1.00717 CAL/MOLE)

BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N. 4. SEE TABLE 5A FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1} - \frac{h^2}{8\pi^2 I_2}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1} - \frac{h^2}{8\pi^2 I_2} - \frac{h^2}{8\pi^2 I_3}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1} - \frac{h^2}{8\pi^2 I_2} - \frac{h^2}{8\pi^2 I_3} - \frac{h^2}{8\pi^2 I_4}$	TEMP. (°K)				
1000	4.2548	2.62339	20.5038	21.2072	5.21312	40.9034	44.1344	3.22082 03	5.21312 03	4.89086 04	1000
1200	4.3592	2.64149	21.0639	23.7053	5.24307	41.8074	47.1064	3.91438 03	5.24307 03	5.02796 04	1200
1400	4.4591	2.65152	21.4719	26.1234	5.26900	42.6442	47.9372	4.59444 03	5.26900 03	5.07206 04	1400
1600	4.5518	2.65611	21.8263	28.4824	5.29182	43.3755	48.4506	5.26856 03	5.29182 03	4.99946 04	1600
1800	4.6367	2.65717	22.1392	30.7964	5.30824	43.9943	49.2746	5.92752 03	5.30824 03	7.91902 04	1800
2000	4.7139	2.65681	22.4191	33.0752	5.31794	44.5595	49.8305	6.58192 03	5.31794 03	8.91806 04	2000
2200	4.7846	2.65547	22.6722	35.3257	5.32289	45.0534	50.2853	7.22802 03	5.32289 03	9.91172 04	2200
2400	4.8476	2.65311	22.9029	37.5530	5.32420	45.5119	50.7781	7.86972 03	5.32420 03	1.09222 05	2400
2600	4.9055	2.64927	23.1169	39.7612	5.32354	45.9331	51.1917	8.50957 03	5.32354 03	1.19432 05	2600
2800	4.9582	2.64421	23.3109	41.9531	5.32050	46.3225	51.5739	9.13732 03	5.32050 03	1.29772 05	2800
3000	5.0044	2.63806	23.4950	44.1311	5.31526	46.6845	51.9267	9.76032 03	5.31526 03	1.40082 05	3000
3200	5.0495	2.63092	23.6637	46.2971	5.30894	47.0226	52.2546	1.03902 04	5.30894 04	1.50472 05	3200
3400	5.0911	2.62287	23.8227	48.4526	5.29999	47.3394	52.5626	1.10122 04	5.29999 04	1.60902 05	3400
3600	5.1284	2.61393	23.9729	50.5980	5.28916	47.6381	52.8563	1.16322 04	5.28916 04	1.71302 05	3600
3800	5.1629	2.60413	24.1149	52.7369	5.27666	47.9200	53.1360	1.22492 04	5.27666 04	1.82102 05	3800
4000	5.1949	2.61040	24.2492	54.8677	5.26335	48.1871	53.3995	1.28632 04	5.26335 04	1.92792 05	4000
4200	5.2246	2.61498	24.3768	56.9918	5.24944	48.4400	53.6572	1.34752 04	5.24944 04	2.03492 05	4200
4400	5.2522	2.61844	24.4984	59.1101	5.23497	48.6824	53.9122	1.40852 04	5.23497 04	2.14202 05	4400
4600	5.2779	2.62085	24.6144	61.2229	5.21962	48.9130	54.1646	1.46942 04	5.21962 04	2.24912 05	4600
4800	5.3020	2.62341	24.7254	63.3306	5.20338	49.1334	54.4160	1.53032 04	5.20338 04	2.35622 05	4800
5000	5.3246	2.62511	24.8317	65.4342	5.18612	49.3447	54.6673	1.59122 04	5.18612 04	2.46332 05	5000
5200	5.3457	2.62674	24.9337	67.5334	5.16886	49.5474	54.9187	1.65212 04	5.16886 04	2.57042 05	5200
5400	5.3654	2.62711	25.0316	69.6289	5.15159	49.7423	55.1692	1.71302 04	5.15159 04	2.67752 05	5400
5600	5.3843	2.62749	25.1262	71.7206	5.13432	49.9299	55.4197	1.77392 04	5.13432 04	2.78462 05	5600
5800	5.4020	2.62720	25.2172	73.8094	5.11706	50.1107	55.6702	1.83482 04	5.11706 04	2.89172 05	5800
6000	5.4187	2.62691	25.3050	75.8949	5.10057	50.2853	55.9207	1.89572 04	5.10057 04	3.00082 05	6000
6200	5.4345	2.62672	25.3899	77.9776	5.14223	50.4599	56.1711	1.95662 04	5.14223 04	3.10992 05	6200
6400	5.4495	2.62643	25.4720	79.0577	5.13007	50.6171	56.4216	2.01752 04	5.13007 04	3.21902 05	6400
6600	5.4637	2.62603	25.5516	80.1352	5.11780	50.7752	56.6721	2.07842 04	5.11780 04	3.32812 05	6600
6800	5.4772	2.62572	25.6287	81.2104	5.10554	50.9284	56.9226	2.13932 04	5.10554 04	3.43722 05	6800
7000	5.4901	2.62549	25.7035	82.2834	5.12666	51.0771	57.1731	2.19922 04	5.12666 04	3.54632 05	7000
7200	5.5023	2.62513	25.7761	83.3563	5.12317	51.2214	57.4236	2.25912 04	5.12317 04	3.65542 05	7200
7400	5.5139	2.62475	25.8467	84.4292	5.11968	51.3618	57.6741	2.31902 04	5.11968 04	3.76452 05	7400
7600	5.5251	2.62438	25.9154	85.5021	5.11619	51.5022	57.9246	2.37892 04	5.11619 04	3.87362 05	7600
7800	5.5357	2.62398	25.9823	86.5750	5.11270	51.6426	58.1751	2.43882 04	5.11270 04	3.98272 05	7800
8000	5.5459	2.62374	26.0474	87.6479	5.11057	51.7829	58.4256	2.49872 04	5.11057 04	4.09182 05	8000
8200	5.5556	2.62346	26.1109	88.7208	5.10872	51.9233	58.6761	2.55862 04	5.10872 04	4.20092 05	8200
8400	5.5650	2.62318	26.1728	89.7937	5.10687	52.0637	58.9266	2.61852 04	5.10687 04	4.31002 05	8400
8600	5.5739	2.62285	26.2333	90.8666	5.10492	52.2041	59.1771	2.67842 04	5.10492 04	4.41912 05	8600
8800	5.5825	2.62247	26.2923	91.9395	5.10297	52.3445	59.4276	2.73832 04	5.10297 04	4.52822 05	8800
9000	5.5908	2.62214	26.3499	93.0124	5.10093	52.4849	59.6781	2.79822 04	5.10093 04	4.63732 05	9000
9200	5.5987	2.62176	26.4063	94.0853	5.09889	52.6253	59.9286	2.85812 04	5.09889 04	4.74642 05	9200
9400	5.6063	2.62138	26.4614	95.1582	5.09684	52.7657	60.1791	2.91802 04	5.09684 04	4.85552 05	9400
9600	5.6137	2.62100	26.5154	96.2311	5.09479	52.9061	60.4296	2.97792 04	5.09479 04	4.96462 05	9600
9800	5.6208	2.62062	26.5682	97.3040	5.09274	53.0465	60.6801	3.03782 04	5.09274 04	5.07372 05	9800

TABLE 10 (CONT.). THERMAL GAS FUNCTIONS FOR AIR

THERM. (°F.)	PRST PSIA	$\frac{U^*}{T}$	$-\frac{U^*}{RT}$	$\ln \frac{U^*}{T}$	$-\ln \frac{U^*}{T}$	$\ln \frac{U^*}{T}$	$\ln \frac{U^*}{T}$	$\ln \frac{U^*}{T}$	$\ln \frac{U^*}{T}$	THERM. (°F.)
10000	5.6276	2.59999	26.6199	29.1795	5.06433	52.0902	57.0045	3.09025	5.06433	10000
10500	5.6437	2.59713	26.7647	29.3019	5.06148	52.1442	57.2277	3.24908	5.06148	10500
11000	5.6594	2.59400	26.9036	29.4105	5.05702	52.2025	58.4995	3.39006	5.05702	11000
11500	5.6719	2.59283	26.9772	29.5300	5.05285	52.2681	59.6010	3.54006	5.05285	11500
12000	5.6845	2.59091	27.0858	29.6367	5.04907	52.3239	59.8950	3.68036	5.04907	12000
12500	5.6961	2.58913	27.1899	29.7390	5.04554	52.3808	59.0943	3.84006	5.04554	12500
13000	5.7060	2.58740	27.2890	29.8373	5.04229	52.4386	59.2917	3.99006	5.04229	13000
13500	5.7170	2.58598	27.3859	29.9319	5.03929	52.4964	59.4797	4.14006	5.03929	13500
14000	5.7284	2.58460	27.4785	30.0231	5.03653	52.5542	59.6689	4.29006	5.03653	14000
14500	5.7392	2.58335	27.5678	30.1111	5.03397	52.6117	59.8599	4.44006	5.03397	14500
15000	5.7496	2.58225	27.6540	30.1962	5.03157	52.6693	60.0009	4.59006	5.03157	15000
15500	5.7514	2.58129	27.7373	30.2786	5.02937	52.7266	60.1406	4.74006	5.02937	15500
16000	5.7509	2.58051	27.8180	30.3585	5.02739	52.7839	60.3273	4.89006	5.02739	16000
16500	5.7660	2.57991	27.8961	30.4361	5.02562	52.8403	60.4615	5.04006	5.02562	16500
17000	5.7729	2.57955	27.9729	30.5115	5.02404	52.8969	60.6314	5.20006	5.02404	17000
17500	5.7795	2.57940	28.0486	30.5850	5.02260	52.9532	60.7734	5.36006	5.02260	17500
18000	5.7859	2.57953	28.1171	30.6567	5.02131	53.0091	60.9199	5.52006	5.02131	18000
18500	5.7922	2.58004	28.1867	30.7267	5.02017	53.0643	61.0591	5.68006	5.02017	18500
19000	5.7985	2.58090	28.2565	30.7954	5.01919	53.1189	61.1955	5.84006	5.01919	19000
19500	5.8047	2.58220	28.3265	30.8627	5.01837	53.1735	61.3292	5.99006	5.01837	19500
20000	5.8110	2.58399	28.3969	30.9280	5.01763	53.2284	61.4607	6.14006	5.01763	20000
20500	5.8166	2.58579	28.4670	31.1953	5.01699	53.2836	61.5903	6.29006	5.01699	20500
21000	5.8240	2.58845	28.5316	31.4599	5.01653	53.3386	62.7137	6.44006	5.01653	21000
21500	5.8317	2.59262	28.6000	31.6902	5.01626	53.3934	62.8409	6.59006	5.01626	21500
22000	5.8394	2.59640	28.6573	31.9570	5.01614	53.4479	63.5030	6.74006	5.01614	22000
22500	5.8477	2.59945	28.7147	32.2631	5.01611	53.5021	64.0724	6.89006	5.01611	22500
23000	5.8555	2.60225	28.7719	32.5533	5.01619	53.5564	64.6467	7.04006	5.01619	23000
23500	5.8630	2.60569	28.8316	32.8389	5.01631	53.6109	65.2267	7.19006	5.01631	23500
24000	5.8704	2.60903	28.8934	33.2405	5.01648	53.6654	65.8119	7.34006	5.01648	24000
24500	5.8781	2.61251	28.9581	33.6272	5.01671	53.7200	66.4027	7.49006	5.01671	24500
25000	5.8861	2.61615	29.0257	34.0182	5.01701	53.7747	67.5997	7.64006	5.01701	25000
25500	5.8945	2.61972	29.0960	34.4135	5.01739	53.8296	68.3953	7.79006	5.01739	25500
26000	5.9031	2.62327	29.1687	34.8091	5.01785	53.8846	69.1935	7.94006	5.01785	26000
26500	5.9117	2.62700	29.2434	35.1859	5.01839	53.9398	69.9942	8.09006	5.01839	26500
27000	5.9201	2.63081	29.3197	35.5503	5.01901	53.9951	71.3922	8.24006	5.01901	27000
27500	5.9284	2.63469	29.3972	35.9044	5.01971	54.0506	71.3922	8.39006	5.01971	27500
28000	5.9367	2.63864	29.4767	36.2582	5.02049	54.1063	71.3922	8.54006	5.02049	28000
28500	5.9449	2.64266	29.5581	36.6116	5.02135	54.1622	71.3922	8.69006	5.02135	28500
29000	5.9530	2.64675	29.6414	36.9647	5.02229	54.2183	71.3922	8.84006	5.02229	29000
29500	5.9610	2.65090	29.7267	37.3174	5.02331	54.2746	71.3922	8.99006	5.02331	29500
30000	5.9689	2.65511	29.8134	37.6697	5.02441	54.3311	71.3922	9.14006	5.02441	30000

TABLE 11. IDEAL GAS FUNCTIONS FOR C ++ (ATOMIC WEIGHT 12.0101, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 55 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2}{8\pi^2 I}$	$\frac{h^2}{8\pi^2 I} - \frac{F_0}{N_A}$	$\ln$	$10^3 \cdot \frac{h^2}{8\pi^2 I} - 10^3 \cdot \frac{F_0}{N_A}$	$\frac{F_0}{N_A}$	$e^{-F_0/N_A}$	$\frac{N^2}{CAL/MOLE}$	$-(F_0 - F_N)$	TEMP. (°K)
3000	1.0000	2.50000	20.8796	22.5706	4.94791	39.9014	44.8494	0.94232	05	3000
3200	1.0000	2.50000	20.8796	22.5706	4.94791	40.2221	45.1900	0.93642	03	3200
3400	1.0000	2.50000	20.8796	22.5706	4.94791	40.5428	45.5306	0.93052	01	3400
3600	1.0000	2.50000	20.8796	22.5706	4.94791	40.8635	45.8712	0.92462	00	3600
4000	1.0000	2.50000	20.8796	22.5706	4.94791	41.1842	46.2118	0.91872	00	4000
4200	1.0000	2.50000	20.8796	22.5706	4.94791	41.5049	46.5524	0.91282	00	4200
4400	1.0000	2.50000	20.8796	22.5706	4.94791	41.8256	46.8930	0.90692	00	4400
4600	1.0000	2.50000	20.8796	22.5706	4.94791	42.1463	47.2336	0.90102	00	4600
5000	1.0000	2.50000	20.8796	22.5706	4.94791	42.4670	47.5742	0.89512	00	5000
5200	1.0000	2.50000	20.8796	22.5706	4.94791	42.7877	47.9148	0.88922	00	5200
5400	1.0000	2.50000	20.8796	22.5706	4.94791	43.1084	48.2554	0.88332	00	5400
5600	1.0000	2.50000	20.8796	22.5706	4.94791	43.4291	48.5960	0.87742	00	5600
6000	1.0000	2.50000	20.8796	22.5706	4.94791	43.7498	48.9366	0.87152	00	6000
6200	1.0000	2.50000	20.8796	22.5706	4.94791	44.0705	49.2772	0.86562	00	6200
6400	1.0000	2.50000	20.8796	22.5706	4.94791	44.3912	49.6178	0.85972	00	6400
6600	1.0000	2.50000	20.8796	22.5706	4.94791	44.7119	49.9584	0.85382	00	6600
7000	1.0000	2.50000	20.8796	22.5706	4.94791	45.0326	50.2990	0.84792	00	7000
7200	1.0000	2.50000	20.8796	22.5706	4.94791	45.3533	50.6396	0.84202	00	7200
7400	1.0000	2.50000	20.8796	22.5706	4.94791	45.6740	50.9802	0.83612	00	7400
7600	1.0000	2.50000	20.8796	22.5706	4.94791	45.9947	51.3208	0.83022	00	7600
8000	1.0000	2.50000	20.8796	22.5706	4.94791	46.3154	51.6614	0.82432	00	8000
8200	1.0000	2.50000	20.8796	22.5706	4.94791	46.6361	52.0020	0.81842	00	8200
8400	1.0000	2.50000	20.8796	22.5706	4.94791	46.9568	52.3426	0.81252	00	8400
8600	1.0000	2.50000	20.8796	22.5706	4.94791	47.2775	52.6832	0.80662	00	8600
9000	1.0000	2.50000	20.8796	22.5706	4.94791	47.5982	53.0238	0.80072	00	9000
9200	1.0000	2.50000	20.8796	22.5706	4.94791	47.9189	53.3644	0.79482	00	9200
9400	1.0000	2.50000	20.8796	22.5706	4.94791	48.2396	53.7050	0.78892	00	9400
9600	1.0000	2.50000	20.8796	22.5706	4.94791	48.5603	54.0456	0.78302	00	9600
10000	1.0000	2.50000	20.8796	22.5706	4.94791	48.8810	54.3862	0.77712	00	10000
10500	1.0000	2.50000	20.8796	22.5706	4.94791	49.2017	54.7268	0.77122	00	10500
11000	1.0000	2.50000	20.8796	22.5706	4.94791	49.5224	55.0674	0.76532	00	11000
11500	1.0000	2.50000	20.8796	22.5706	4.94791	49.8431	55.4080	0.75942	00	11500
12000	1.0000	2.50000	20.8796	22.5706	4.94791	50.1638	55.7486	0.75352	00	12000
12500	1.0000	2.50000	20.8796	22.5706	4.94791	50.4845	56.0892	0.74762	00	12500
13000	1.0000	2.50000	20.8796	22.5706	4.94791	50.8052	56.4298	0.74172	00	13000
13500	1.0000	2.50000	20.8796	22.5706	4.94791	51.1259	56.7704	0.73582	00	13500
14000	1.0000	2.50000	20.8796	22.5706	4.94791	51.4466	57.1110	0.72992	00	14000
14500	1.0000	2.50000	20.8796	22.5706	4.94791	51.7673	57.4516	0.72402	00	14500



TABLE 12. IDEAL GAS FUNCTIONS FOR  $H_2$  (ATOMIC WEIGHT 1.00794,  $R = 1.98717$  CAL/MOLE)

BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 54 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL PRESS.	$\frac{U^0 - U}{RT}$	$\frac{H^0 - H}{RT}$	$\frac{S^0 - S}{R}$	$\ln \frac{U^0 - U}{RT} - \frac{H^0 - H}{RT}$	$\frac{S^0 - S}{R}$	$\frac{U^0 - U}{RT} - \frac{H^0 - H}{RT}$	$\frac{U^0 - U}{RT} - \frac{H^0 - H}{RT}$	TEMP. (°K)
3000	5.6789	2.55422	22.0449	24.6811	5.07565	43.0108	48.0865	9.24546	3000
3200	5.6982	2.55092	22.2116	24.7424	5.06910	43.0108	48.0865	9.24546	3200
3400	5.7151	2.54800	22.3462	24.7852	5.06336	43.0108	48.0865	9.24546	3400
3600	5.7305	2.54540	22.4518	24.8172	5.05813	43.0108	48.0865	9.24546	3600
3800	5.7443	2.54307	22.5343	24.8403	5.05339	43.0108	48.0865	9.24546	3800
4000	5.7566	2.54096	22.5997	24.8557	5.04911	43.0108	48.0865	9.24546	4000
4200	5.7679	2.53905	22.6506	24.8637	5.04521	43.0108	48.0865	9.24546	4200
4400	5.7781	2.53731	22.6877	24.8640	5.04166	43.0108	48.0865	9.24546	4400
4600	5.7875	2.53572	22.7135	24.8572	5.03844	43.0108	48.0865	9.24546	4600
4800	5.7962	2.53426	22.7294	24.8424	5.03555	43.0108	48.0865	9.24546	4800
5000	5.8041	2.53291	22.7369	24.8197	5.03302	43.0108	48.0865	9.24546	5000
5200	5.8115	2.53167	22.7351	24.7880	5.03085	43.0108	48.0865	9.24546	5200
5400	5.8183	2.53052	22.7246	24.7481	5.02904	43.0108	48.0865	9.24546	5400
5600	5.8246	2.52945	22.7055	24.7019	5.02758	43.0108	48.0865	9.24546	5600
5800	5.8305	2.52846	22.6784	24.6500	5.02647	43.0108	48.0865	9.24546	5800
6000	5.8360	2.52754	22.6439	24.5934	5.02569	43.0108	48.0865	9.24546	6000
6200	5.8413	2.52668	22.6024	24.5324	5.02523	43.0108	48.0865	9.24546	6200
6400	5.8462	2.52588	22.5546	24.4670	5.02509	43.0108	48.0865	9.24546	6400
6600	5.8507	2.52513	22.5009	24.4079	5.02526	43.0108	48.0865	9.24546	6600
6800	5.8551	2.52444	22.4422	24.3457	5.02564	43.0108	48.0865	9.24546	6800
7000	5.8592	2.52381	22.3794	24.2801	5.02623	43.0108	48.0865	9.24546	7000
7200	5.8630	2.52325	22.3125	24.2116	5.02707	43.0108	48.0865	9.24546	7200
7400	5.8667	2.52275	22.2424	24.1409	5.02813	43.0108	48.0865	9.24546	7400
7600	5.8703	2.52231	22.1694	24.0681	5.02940	43.0108	48.0865	9.24546	7600
7800	5.8736	2.52192	22.0934	23.9932	5.03087	43.0108	48.0865	9.24546	7800
8000	5.8768	2.52161	22.0144	23.9164	5.03254	43.0108	48.0865	9.24546	8000
8200	5.8799	2.52136	21.9324	23.8379	5.03440	43.0108	48.0865	9.24546	8200
8400	5.8829	2.52116	21.8474	23.7574	5.03645	43.0108	48.0865	9.24546	8400
8600	5.8857	2.52102	21.7594	23.6744	5.03869	43.0108	48.0865	9.24546	8600
8800	5.8885	2.52092	21.6684	23.5884	5.04112	43.0108	48.0865	9.24546	8800
9000	5.8912	2.52086	21.5744	23.5004	5.04374	43.0108	48.0865	9.24546	9000
9200	5.8939	2.52083	21.4774	23.4104	5.04654	43.0108	48.0865	9.24546	9200
9400	5.8964	2.52082	21.3774	23.3184	5.04951	43.0108	48.0865	9.24546	9400
9600	5.8989	2.52082	21.2744	23.2244	5.05264	43.0108	48.0865	9.24546	9600
9800	5.9015	2.52084	21.1684	23.1284	5.05594	43.0108	48.0865	9.24546	9800
10000	5.9040	2.52101	21.0594	23.0304	5.05940	43.0108	48.0865	9.24546	10000
10200	5.9064	2.52126	20.9474	22.9304	5.06302	43.0108	48.0865	9.24546	10200
10400	5.9088	2.52159	20.8324	22.8274	5.06680	43.0108	48.0865	9.24546	10400
10600	5.9112	2.52199	20.7144	22.7214	5.07074	43.0108	48.0865	9.24546	10600
10800	5.9136	2.52245	20.5934	22.6124	5.07484	43.0108	48.0865	9.24546	10800
11000	5.9159	2.52297	20.4694	22.5004	5.07910	43.0108	48.0865	9.24546	11000
11200	5.9182	2.52354	20.3424	22.3854	5.08352	43.0108	48.0865	9.24546	11200
11400	5.9205	2.52416	20.2124	22.2674	5.08810	43.0108	48.0865	9.24546	11400
11600	5.9227	2.52483	20.0794	22.1464	5.09284	43.0108	48.0865	9.24546	11600
11800	5.9249	2.52555	19.9434	22.0224	5.09774	43.0108	48.0865	9.24546	11800
12000	5.9270	2.52631	19.8044	21.8954	5.10280	43.0108	48.0865	9.24546	12000
12200	5.9291	2.52711	19.6624	21.7654	5.10802	43.0108	48.0865	9.24546	12200
12400	5.9311	2.52795	19.5174	21.6324	5.11340	43.0108	48.0865	9.24546	12400
12600	5.9331	2.52883	19.3694	21.4964	5.11894	43.0108	48.0865	9.24546	12600
12800	5.9350	2.52975	19.2184	21.3574	5.12464	43.0108	48.0865	9.24546	12800
13000	5.9369	2.53071	19.0644	21.2154	5.13050	43.0108	48.0865	9.24546	13000
13200	5.9387	2.53171	18.9074	21.0704	5.13652	43.0108	48.0865	9.24546	13200
13400	5.9405	2.53274	18.7484	20.9224	5.14270	43.0108	48.0865	9.24546	13400
13600	5.9423	2.53381	18.5864	20.7714	5.14904	43.0108	48.0865	9.24546	13600
13800	5.9440	2.53491	18.4214	20.6174	5.15554	43.0108	48.0865	9.24546	13800
14000	5.9457	2.53604	18.2534	20.4604	5.16220	43.0108	48.0865	9.24546	14000
14200	5.9473	2.53721	18.0824	20.3004	5.16902	43.0108	48.0865	9.24546	14200
14400	5.9489	2.53841	17.9084	20.1374	5.17600	43.0108	48.0865	9.24546	14400
14600	5.9504	2.53964	17.7314	19.9714	5.18314	43.0108	48.0865	9.24546	14600
14800	5.9519	2.54090	17.5514	19.8024	5.19044	43.0108	48.0865	9.24546	14800
15000	5.9533	2.54219	17.3684	19.6304	5.19790	43.0108	48.0865	9.24546	15000



TABLE 13. TOTAL GAS FUNCTIONS PER G+ (ATOMIC WEIGHT 15.9993, R = 1.08717 CAL/DEGREE)

[illegible]



TABLE 13 (CONT.). IDEAL GAS FUNCTIONS FOR O++

[illegible]

TABLE 14. IDEAL GAS FUNCTIONS FOR AR++ (ATOMIC WEIGHT 39.9470, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 9B FOR LIST OF STATES USED.

TEMP. (°K)	PARTIC. FUNCT.	$\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT} - \frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	TEMP. (°K)
3000	7.2309	2.66431	23.0019	24.6662	9.99410	97.5107	96.7509	1.00410	0	1.00000	0	3000
3200	7.3224	2.67975	24.0344	26.7153	9.32511	97.4707	95.0856	1.04810	0	1.00000	0	3200
3400	7.4017	2.69690	24.4199	28.8129	8.67833	97.4307	92.7509	1.13240	0	1.00000	0	3400
3600	7.4759	2.71504	24.8198	30.9598	8.04770	97.3907	89.4209	1.24900	0	1.00000	0	3600
3800	7.5457	2.73403	25.2342	33.1551	7.43037	97.3507	86.0511	1.39810	0	1.00000	0	3800
4000	7.6118	2.75391	25.6631	35.4002	6.82493	97.3107	82.6413	1.58060	0	1.00000	0	4000
4200	7.6748	2.77464	26.1064	37.6957	6.23022	97.2707	79.1915	1.79750	0	1.00000	0	4200
4400	7.7351	2.79621	26.5642	39.9423	5.64537	97.2307	75.7017	2.04900	0	1.00000	0	4400
4600	7.7931	2.81863	27.0364	42.1502	5.07022	97.1907	72.1719	2.33450	0	1.00000	0	4600
4800	7.8492	2.84194	27.5229	44.3207	4.50457	97.1507	68.6021	2.64900	0	1.00000	0	4800
5000	7.9037	2.86614	28.0237	46.4542	3.94842	97.1107	65.0023	2.99350	0	1.00000	0	5000
5200	7.9567	2.89125	28.5384	48.5607	3.40127	97.0707	61.3725	3.36800	0	1.00000	0	5200
5400	8.0084	2.91728	29.0672	50.6402	2.86212	97.0307	57.7127	3.77250	0	1.00000	0	5400
5600	8.0593	2.94423	29.6097	52.6927	2.33097	96.9907	54.0229	4.20700	0	1.00000	0	5600
5800	8.1091	2.97210	30.1662	54.7172	1.80682	96.9507	50.3031	4.66150	0	1.00000	0	5800
6000	8.1581	2.60064	25.7142	28.3928	5.32294	91.0903	54.4213	2.00150	0	3.19300	0	6000
6200	8.2043	2.62806	26.2802	30.4829	4.82732	91.0429	50.6902	2.47090	0	3.30290	0	6200
6400	8.2439	2.65512	26.8512	32.5373	4.33101	91.0000	46.9946	2.94030	0	3.41240	0	6400
6600	8.2808	2.68182	27.4262	34.5562	3.83483	90.9575	43.2426	3.40970	0	3.52200	0	6600
6800	8.3172	2.70817	28.0150	36.5397	3.33865	90.9150	39.4726	3.87910	0	3.63100	0	6800
7000	8.3530	2.73427	28.6077	38.4872	2.84247	90.8725	35.6826	4.34850	0	3.74100	0	7000
7200	8.3883	2.76012	29.2042	40.4007	2.34630	90.8300	31.8726	4.81790	0	3.85100	0	7200
7400	8.4232	2.78572	29.8047	42.2802	1.85012	90.7875	28.0426	5.28730	0	3.96100	0	7400
7600	8.4576	2.81117	30.4092	44.1357	1.35395	90.7450	24.1926	5.75670	0	4.07100	0	7600
7800	8.4915	2.83647	31.0187	45.9682	0.85777	90.7025	20.3226	6.22610	0	4.18100	0	7800
8000	8.5249	2.86162	31.6322	47.7707	0.36160	90.6600	16.4326	6.69550	0	4.29100	0	8000
8200	8.5578	2.88672	32.2497	49.5452	-0.13457	90.6175	12.5226	7.16490	0	4.40100	0	8200
8400	8.5903	2.91177	32.8712	51.2927	-0.63840	90.5750	8.5926	7.63430	0	4.51100	0	8400
8600	8.6224	2.93672	33.4967	53.0152	-1.14223	90.5325	4.6426	8.10370	0	4.62100	0	8600
8800	8.6541	2.96157	34.1252	54.7152	-1.64606	90.4900	0.6926	8.57310	0	4.73100	0	8800
9000	8.6854	2.98632	34.7567	56.3927	-2.14989	90.4475	-3.2576	9.04250	0	4.84100	0	9000
9200	8.7163	3.01097	35.3902	58.0472	-2.65372	90.4050	-7.3076	9.51190	0	4.95100	0	9200
9400	8.7468	3.03552	36.0257	59.6797	-3.15755	90.3625	-11.3576	9.98130	0	5.06100	0	9400
9600	8.7769	3.06007	36.6632	61.2922	-3.66138	90.3200	-15.4076	10.45070	0	5.17100	0	9600
9800	8.8066	3.08452	37.3027	62.8847	-4.16521	90.2775	-19.4576	10.92010	0	5.28100	0	9800
10000	8.8359	3.10897	37.9442	64.4572	-4.66904	90.2350	-23.5076	11.38950	0	5.39100	0	10000
10200	8.8648	3.13332	38.5877	66.0117	-5.17287	90.1925	-27.5576	11.85890	0	5.50100	0	10200
10400	8.8933	3.15757	39.2332	67.5472	-5.67670	90.1500	-31.6076	12.32830	0	5.61100	0	10400
10600	8.9214	3.18172	39.8807	69.0647	-6.18053	90.1075	-35.6576	12.79770	0	5.72100	0	10600
10800	8.9491	3.20587	40.5292	70.5642	-6.68436	90.0650	-39.7076	13.26710	0	5.83100	0	10800
11000	8.9764	3.23002	41.1787	72.0467	-7.18819	90.0225	-43.7576	13.73650	0	5.94100	0	11000
11200	8.9999	3.25417	41.8292	73.5122	-7.69202	90.0000	-47.8076	14.20590	0	6.05100	0	11200
11400	9.0224	3.27832	42.4797	74.9647	-8.19585	90.0000	-51.8576	14.67530	0	6.16100	0	11400
11600	9.0449	3.30247	43.1292	76.4042	-8.69968	90.0000	-55.9076	15.14470	0	6.27100	0	11600
11800	9.0674	3.32662	43.7787	77.8347	-9.20351	90.0000	-60.0000	15.61410	0	6.38100	0	11800
12000	9.0899	3.35077	44.4282	79.2542	-9.70734	90.0000	-64.1000	16.08350	0	6.49100	0	12000
12200	9.1124	3.37492	45.0777	80.6647	-10.21117	90.0000	-68.2000	16.55290	0	6.60100	0	12200
12400	9.1349	3.39907	45.7272	82.0642	-10.71500	90.0000	-72.3000	17.02230	0	6.71100	0	12400
12600	9.1574	3.42322	46.3767	83.4547	-11.21883	90.0000	-76.4000	17.49170	0	6.82100	0	12600
12800	9.1799	3.44737	47.0262	84.8342	-11.72266	90.0000	-80.5000	17.96110	0	6.93100	0	12800
13000	9.2024	3.47152	47.6757	86.2047	-12.22649	90.0000	-84.6000	18.43050	0	7.04100	0	13000
13200	9.2249	3.49567	48.3252	87.5642	-12.73032	90.0000	-88.7000	18.89990	0	7.15100	0	13200
13400	9.2474	3.51982	48.9747	88.9147	-13.23415	90.0000	-92.8000	19.36930	0	7.26100	0	13400
13600	9.2699	3.54397	49.6242	90.2542	-13.73798	90.0000	-96.9000	19.83870	0	7.37100	0	13600
13800	9.2924	3.56812	50.2737	91.5847	-14.24181	90.0000	-101.0000	20.30810	0	7.48100	0	13800
14000	9.3149	3.59227	50.9232	92.9042	-14.74564	90.0000	-105.1000	20.77750	0	7.59100	0	14000
14200	9.3374	3.61642	51.5727	94.2147	-15.24947	90.0000	-109.2000	21.24690	0	7.70100	0	14200
14400	9.3599	3.64057	52.2222	95.5142	-15.75330	90.0000	-113.3000	21.71630	0	7.81100	0	14400
14600	9.3824	3.66472	52.8717	96.8047	-16.25713	90.0000	-117.4000	22.18570	0	7.92100	0	14600
14800	9.4049	3.68887	53.5212	98.0842	-16.76096	90.0000	-121.5000	22.65510	0	8.03100	0	14800
15000	9.4274	3.71302	54.1707	99.3547	-17.26479	90.0000	-125.6000	23.12450	0	8.14100	0	15000

TABLE 14 (CONT.). IDEAL GAS FUNCTIONS FOR  $Ar \leftrightarrow$

[illegible]

TABLE 15. IDEAL GAS FUNCTIONS FOR C 3+ (ATOMIC WEIGHT 12.0095, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 59 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{W^0 - E^0}{RT}$	$\frac{F^0 - E^0}{RT}$	$\frac{S^0}{R}$	$\ln \frac{W^0 - E^0}{RT}$	$-\ln \frac{F^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT}$	$\ln \frac{F^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT}$	$-\ln \frac{F^0 - E^0}{RT}$	TEMP. (°K)
3000	2.0000	2.50000	20.7727	23.2727	4.96791	41.2797	44.2446	8.95342E 03	1.4904E 04	1.2304E 05	3000
3200	2.0000	2.49999	20.9340	23.4340	4.96791	41.5793	44.5672	9.53042E 03	1.5097E 04	1.3312E 05	3200
3400	2.0000	2.50000	21.0856	23.5856	4.96791	41.9005	44.8644	1.01335E 04	1.6091E 04	1.4244E 05	3400
3600	2.0000	2.50000	21.2285	23.7285	4.96791	42.1845	47.1524	1.0731E 04	1.7004E 04	1.5186E 05	3600
3800	2.0000	2.50000	21.3636	23.8636	4.96791	42.4531	47.4210	1.1327E 04	1.8070E 04	1.6132E 05	3800
4000	2.0000	2.50000	21.4919	23.9919	4.96791	42.7079	47.6750	1.1923E 04	1.9072E 04	1.7083E 05	4000
4200	2.0000	2.50000	21.6136	24.1136	4.96791	42.9503	47.9182	1.2519E 04	2.0095E 04	1.8039E 05	4200
4400	2.0000	2.50000	21.7301	24.2301	4.96791	43.1814	48.1493	1.3115E 04	2.1059E 04	1.9000E 05	4400
4600	2.0000	2.50000	21.8413	24.3413	4.96791	43.4022	48.3701	1.3711E 04	2.2052E 04	2.0000E 05	4600
4800	2.0000	2.50000	21.9477	24.4477	4.96791	43.6136	48.5816	1.4308E 04	2.3044E 04	2.0932E 05	4800
5000	2.0000	2.50000	22.0497	24.5497	4.96791	43.8164	48.7844	1.4904E 04	2.4040E 04	2.1908E 05	5000
5200	2.0000	2.50000	22.1478	24.6478	4.96791	44.0113	48.9792	1.5500E 04	2.5033E 04	2.2886E 05	5200
5400	2.0000	2.50000	22.2421	24.7421	4.96791	44.2088	49.1668	1.6096E 04	2.6027E 04	2.3867E 05	5400
5600	2.0000	2.50000	22.3330	24.8330	4.96791	44.3982	49.3474	1.6692E 04	2.7020E 04	2.4851E 05	5600
5800	2.0000	2.50001	22.4208	24.9208	4.96792	44.5895	49.5217	1.7288E 04	2.8014E 04	2.5841E 05	5800
6000	2.0000	2.50001	22.5055	25.0055	4.96793	44.7722	49.6901	1.7885E 04	2.9008E 04	2.6833E 05	6000
6200	2.0000	2.50001	22.5875	25.0875	4.96794	44.9561	49.8530	1.8481E 04	3.0002E 04	2.7827E 05	6200
6400	2.0000	2.50002	22.6669	25.1669	4.96794	45.1428	50.0108	1.9077E 04	3.1000E 04	2.8827E 05	6400
6600	2.0000	2.50003	22.7438	25.2438	4.96798	45.3297	50.1637	1.9673E 04	3.2000E 04	2.9834E 05	6600
6800	2.0000	2.50005	22.8184	25.3185	4.96801	45.5140	50.3120	2.0270E 04	3.3000E 04	3.0846E 05	6800
7000	2.0000	2.50007	22.8909	25.3910	4.96805	45.6980	50.4561	2.0866E 04	3.4000E 04	3.1862E 05	7000
7200	2.0000	2.50010	22.9613	25.4614	4.96811	45.8790	50.5961	2.1463E 04	3.5000E 04	3.2882E 05	7200
7400	2.0000	2.50013	23.0298	25.5299	4.96818	46.0574	50.7323	2.2059E 04	3.6000E 04	3.3906E 05	7400
7600	2.0000	2.50018	23.0965	25.5967	4.96827	46.2344	50.8649	2.2656E 04	3.7000E 04	3.4931E 05	7600
7800	2.0000	2.50024	23.1615	25.6617	4.96839	46.4096	50.9940	2.3254E 04	3.8000E 04	3.5960E 05	7800
8000	2.0001	2.50032	23.2248	25.7251	4.96854	46.5814	51.1200	2.3851E 04	3.9000E 04	3.6992E 05	8000
8200	2.0001	2.50041	23.2865	25.7869	4.96873	46.7501	51.2428	2.4449E 04	4.0000E 04	3.8027E 05	8200
8400	2.0001	2.50052	23.3468	25.8473	4.96895	46.9169	51.3628	2.5047E 04	4.1000E 04	3.9071E 05	8400
8600	2.0001	2.50064	23.4056	25.9063	4.96923	47.0823	51.4800	2.5644E 04	4.2000E 04	4.0120E 05	8600
8800	2.0002	2.50083	23.4631	25.9639	4.96955	47.2456	51.5946	2.6242E 04	4.3000E 04	4.1173E 05	8800
9000	2.0002	2.50102	23.5193	26.0203	4.96994	47.4077	51.7067	2.6840E 04	4.4000E 04	4.2230E 05	9000
9200	2.0002	2.50125	23.5743	26.0755	4.97040	47.5686	51.8163	2.7438E 04	4.5000E 04	4.3290E 05	9200
9400	2.0003	2.50152	23.6281	26.1296	4.97092	47.7284	51.9236	2.8037E 04	4.6000E 04	4.4352E 05	9400
9600	2.0004	2.50182	23.6807	26.1825	4.97151	47.8875	52.0290	2.8636E 04	4.7000E 04	4.5417E 05	9600
9800	2.0005	2.50218	23.7323	26.2345	4.97224	48.0456	52.1323	2.9235E 04	4.8000E 04	4.6487E 05	9800
10000	2.0006	2.50258	23.7829	26.2854	4.97303	48.2026	52.2335	2.9834E 04	4.9000E 04	4.7560E 05	10000
10500	2.0009	2.50382	23.9050	26.4088	4.97550	48.5032	52.4787	3.1378E 04	5.2243E 04	4.9070E 05	10500
11000	2.0013	2.50545	24.0215	26.5270	4.97874	48.7347	52.7135	3.2907E 04	5.5764E 04	5.2500E 05	11000
11500	2.0018	2.50752	24.1329	26.6404	4.98266	48.9561	52.9390	3.4430E 04	5.9390E 04	5.7100E 05	11500
12000	2.0026	2.51099	24.2397	26.7498	4.98796	49.1683	53.1562	3.5950E 04	6.3030E 04	6.1700E 05	12000
12500	2.0036	2.51519	24.3422	26.8554	4.99413	49.3720	53.3642	3.7507E 04	6.6670E 04	6.6300E 05	12500
13000	2.0047	2.51987	24.4409	26.9577	5.00144	49.5660	53.5695	3.9084E 04	7.0310E 04	7.0900E 05	13000
13500	2.0062	2.52515	24.5359	27.0571	5.00995	49.7510	53.7699	4.0680E 04	7.3940E 04	7.5500E 05	13500
14000	2.0079	2.53106	24.6277	27.1538	5.01960	49.9276	53.9660	4.2295E 04	7.7570E 04	8.0100E 05	14000
14500	2.0099	2.53769	24.7166	27.2480	5.03009	49.1137	54.1604	4.4131E 04	8.1210E 04	8.4700E 05	14500

TABLE 15 (CONT.). IDEAL GAS FUNCTIONS FOR C<sub>3</sub>H<sub>8</sub>

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2}{RT}$	$-\frac{F^0 - F}{RT}$	$\ln \frac{P}{P^0}$	$\ln \frac{P}{P^0} - \frac{F^0 - F}{RT}$	$\ln \frac{P}{P^0} - \frac{F^0 - F}{RT} - \ln \frac{P}{P^0}$	$\ln \frac{P}{P^0} - \frac{F^0 - F}{RT} - \ln \frac{P}{P^0} - \ln \frac{P}{P^0}$	TEMP. (°K)
19000	2.0123	2.53776	26.8024	27.3401	5.04296	49.2644	54.3294	19000
15000	2.0150	2.54457	26.8057	27.4303	5.05647	49.2644	54.3294	15000
14000	2.0181	2.55199	26.8066	27.5186	5.07122	49.2644	54.3294	14000
13000	2.0215	2.56000	26.8092	27.6052	5.08715	49.2644	54.3294	13000
12000	2.0254	2.56859	26.8128	27.6904	5.10422	49.2644	54.3294	12000
11000	2.0297	2.57773	26.8164	27.7741	5.12231	49.2644	54.3294	11000
10000	2.0344	2.58737	26.8201	27.8565	5.14153	49.2644	54.3294	10000
9000	2.0396	2.59748	26.8240	27.9376	5.16162	49.2644	54.3294	9000
8000	2.0452	2.60803	26.8281	28.0174	5.18258	49.2644	54.3294	8000
7000	2.0512	2.61896	26.8323	28.0964	5.20431	49.2644	54.3294	7000
6000	2.0577	2.63026	26.8366	28.1741	5.22673	49.2644	54.3294	6000
5000	2.0648	2.64191	26.8410	28.2508	5.25083	49.2644	54.3294	5000
4000	2.0724	2.65392	26.8456	28.3266	5.27661	49.2644	54.3294	4000
3000	2.0806	2.66630	26.8503	28.4015	5.30407	49.2644	54.3294	3000
2000	2.0893	2.67905	26.8552	28.4756	5.33321	49.2644	54.3294	2000
1000	2.0985	2.69218	26.8602	28.5489	5.36403	49.2644	54.3294	1000
500	2.1081	2.70569	26.8653	28.6214	5.39654	49.2644	54.3294	500
200	2.1181	2.71958	26.8705	28.6931	5.43075	49.2644	54.3294	200
100	2.1284	2.73385	26.8758	28.7641	5.46666	49.2644	54.3294	100
50	2.1390	2.74850	26.8812	28.8344	5.50427	49.2644	54.3294	50
20	2.1500	2.76353	26.8867	28.9041	5.54358	49.2644	54.3294	20
10	2.1614	2.77894	26.8923	28.9732	5.58460	49.2644	54.3294	10
5	2.1732	2.79473	26.8980	29.0417	5.62733	49.2644	54.3294	5
2	2.1854	2.81091	26.9038	29.1096	5.67178	49.2644	54.3294	2
1	2.1980	2.82748	26.9097	29.1769	5.71795	49.2644	54.3294	1
0.5	2.2109	2.84444	26.9157	29.2436	5.76584	49.2644	54.3294	0.5
0.2	2.2241	2.86179	26.9218	29.3097	5.81545	49.2644	54.3294	0.2
0.1	2.2376	2.87954	26.9280	29.3752	5.86678	49.2644	54.3294	0.1
0.05	2.2514	2.89768	26.9343	29.4401	5.91984	49.2644	54.3294	0.05
0.02	2.2655	2.91621	26.9407	29.5044	5.97463	49.2644	54.3294	0.02
0.01	2.2799	2.93513	26.9472	29.5681	6.03015	49.2644	54.3294	0.01
0.005	2.2946	2.95444	26.9538	29.6312	6.08640	49.2644	54.3294	0.005
0.002	2.3095	2.97415	26.9605	29.6937	6.14339	49.2644	54.3294	0.002
0.001	2.3246	2.99426	26.9673	29.7556	6.20112	49.2644	54.3294	0.001
0.0005	2.3399	3.01477	26.9741	29.8169	6.25960	49.2644	54.3294	0.0005
0.0002	2.3554	3.03568	26.9810	29.8776	6.31883	49.2644	54.3294	0.0002
0.0001	2.3710	3.05699	26.9880	29.9377	6.37891	49.2644	54.3294	0.0001
0.00005	2.3867	3.07860	26.9950	29.9972	6.43984	49.2644	54.3294	0.00005
0.00002	2.4025	3.09951	27.0021	30.0561	6.50162	49.2644	54.3294	0.00002
0.00001	2.4184	3.12072	27.0092	30.1144	6.56425	49.2644	54.3294	0.00001
0.000005	2.4344	3.14223	27.0163	30.1721	6.62773	49.2644	54.3294	0.000005
0.000002	2.4505	3.16404	27.0234	30.2292	6.69206	49.2644	54.3294	0.000002
0.000001	2.4667	3.18615	27.0305	30.2857	6.75724	49.2644	54.3294	0.000001
0.0000005	2.4830	3.20856	27.0376	30.3416	6.82327	49.2644	54.3294	0.0000005
0.0000002	2.4993	3.23127	27.0447	30.3969	6.89015	49.2644	54.3294	0.0000002
0.0000001	2.5157	3.25428	27.0518	30.4516	6.95788	49.2644	54.3294	0.0000001
0.00000005	2.5322	3.27759	27.0589	30.5057	7.02646	49.2644	54.3294	0.00000005
0.00000002	2.5488	3.30120	27.0660	30.5592	7.09589	49.2644	54.3294	0.00000002
0.00000001	2.5655	3.32511	27.0731	30.6121	7.16617	49.2644	54.3294	0.00000001
0.000000005	2.5822	3.34932	27.0802	30.6644	7.23730	49.2644	54.3294	0.000000005
0.000000002	2.5990	3.37383	27.0873	30.7161	7.30928	49.2644	54.3294	0.000000002
0.000000001	2.6158	3.39864	27.0944	30.7672	7.38211	49.2644	54.3294	0.000000001
0.0000000005	2.6327	3.42375	27.1015	30.8177	7.45580	49.2644	54.3294	0.0000000005
0.0000000002	2.6496	3.44916	27.1086	30.8676	7.53034	49.2644	54.3294	0.0000000002
0.0000000001	2.6665	3.47487	27.1157	30.9169	7.60573	49.2644	54.3294	0.0000000001
0.00000000005	2.6834	3.50088	27.1228	30.9656	7.68197	49.2644	54.3294	0.00000000005
0.00000000002	2.7003	3.52709	27.1299	31.0137	7.75906	49.2644	54.3294	0.00000000002
0.00000000001	2.7172	3.55350	27.1370	31.0612	7.83700	49.2644	54.3294	0.00000000001
0.000000000005	2.7341	3.58011	27.1441	31.1081	7.91579	49.2644	54.3294	0.000000000005
0.000000000002	2.7510	3.60692	27.1512	31.1544	7.99543	49.2644	54.3294	0.000000000002
0.000000000001	2.7679	3.63393	27.1583	31.2001	8.07592	49.2644	54.3294	0.000000000001
0.0000000000005	2.7848	3.66114	27.1654	31.2452	8.15726	49.2644	54.3294	0.0000000000005
0.0000000000002	2.8017	3.68855	27.1725	31.2907	8.23945	49.2644	54.3294	0.0000000000002
0.0000000000001	2.8186	3.71616	27.1796	31.3356	8.32249	49.2644	54.3294	0.0000000000001
0.00000000000005	2.8355	3.74387	27.1867	31.3801	8.40638	49.2644	54.3294	0.00000000000005
0.00000000000002	2.8524	3.77168	27.1938	31.4241	8.49112	49.2644	54.3294	0.00000000000002
0.00000000000001	2.8693	3.79959	27.2009	31.4676	8.57671	49.2644	54.3294	0.00000000000001
0.000000000000005	2.8862	3.82760	27.2080	31.5116	8.66315	49.2644	54.3294	0.000000000000005
0.000000000000002	2.9031	3.85581	27.2151	31.5551	8.75044	49.2644	54.3294	0.000000000000002
0.000000000000001	2.9200	3.88422	27.2222	31.5981	8.83858	49.2644	54.3294	0.000000000000001
0.0000000000000005	2.9369	3.91283	27.2293	31.6416	8.92757	49.2644	54.3294	0.0000000000000005
0.0000000000000002	2.9538	3.94164	27.2364	31.6846	9.01741	49.2644	54.3294	0.0000000000000002
0.0000000000000001	2.9707	3.97065	27.2435	31.7271	9.10810	49.2644	54.3294	0.0000000000000001
0.00000000000000005	2.9876	3.99986	27.2506	31.7691	9.20064	49.2644	54.3294	0.00000000000000005
0.00000000000000002	3.0045	4.02927	27.2577	31.8106	9.29403	49.2644	54.3294	0.00000000000000002
0.00000000000000001	3.0214	4.05888	27.2648	31.8516	9.38827	49.2644	54.3294	0.00000000000000001
0.000000000000000005	3.0383	4.08869	27.2719	31.8921	9.48336	49.2644	54.3294	0.000000000000000005
0.000000000000000002	3.0552	4.11870	27.2790	31.9321	9.57930	49.2644	54.3294	0.000000000000000002
0.000000000000000001	3.0721	4.14891	27.2861	31.9716	9.67609	49.2644	54.3294	0.000000000000000001
0.0000000000000000005	3.0890	4.17932	27.2932	32.0106	9.77373	49.2644	54.3294	0.0000000000000000005
0.0000000000000000002	3.1059	4.20993	27.3003	32.0491	9.87222	49.2644	54.3294	0.0000000000000000002
0.0000000000000000001	3.1228	4.24074	27.3074	32.0871	9.97156	49.2644	54.3294	0.0000000000000000001
0.00000000000000000005	3.1397	4.27175	27.3145	32.1246	10.07175	49.2644	54.3294	0.00000000000000000005
0.00000000000000000002	3.1566	4.30296	27.3216	32.1616	10.17279	49.2644	54.3294	0.00000000000000000002
0.00000000000000000001	3.1735	4.33437	27.3287	32.1981	10.27468	49.2644	54.3294	0.00000000000000000001
0.000000000000000000005	3.1904	4.36598	27.3358	32.2341	10.37742	49.2644	54.3294	0.000000000000000000005
0.000000000000000000002	3.2073	4.39779	27.3429	32.2696	10.48101	49.2644	54.3294	0.000000000000000000002
0.000000000000000000001	3.2242	4.42980	27.3500	32.3046	10.58545	49.2644	54.3294	0.000000000000000000001
0.0000000000000000000005	3.2411	4.46201	27.3571	32.3391	10.69074	49.2644	54.3294	0.0000000000000000000005
0.0000000000000000000002	3.2580	4.49442	27.3642	32.3731	10.79688	49.2644	54.3294	0.0000000000000000000002
0.0000000000000000000001	3.2749	4.52703	27.3713	32.4066	10.90387	49.2644	54.3294	0.0000000000000000000001
0.00000000000000000000005	3.2918	4.55984	27.3784	32.4396	11.01171	49.2644	54.3294	0.00000000000000000000005
0.00000000000000000000002	3.3087	4.59285	27.3855	32.4721	11.12040	49.2644	54.3294	0.00000000000000000000002
0.00000000000000000000001	3.3256	4.62606	27.3926	32.5041	11.22994	49.2644	54.3294	0.00000000000000000000001
0.000000000000000000000005	3.3425	4.65947	27.4000	32.5356	11.34033	49.2644	54.3294	0.000000000000000000000005
0.000000000000000000000002	3.3594	4.69308	27.4071	32.5666	11.45157	49.2644	54.3294	0.000000000000000000000002
0.000000000000000000000001	3.3763	4.72689	27.4142	32.5971	11.56366	49.2644	54.3294	0.000000000000000000000001
0.0000000000000000000000005	3.3932	4.76090	27.4213	32.6271	11.67660	49.2644	54.3294	0.0000000000000000000000005
0.0000000000000000000000002	3.4101	4.79511	27.4284	32.6566	11.79039	49.2644	54.3294	0.000000000000000

TABLE 16. IDEAL GAS FUNCTIONS FOR N<sub>2</sub> (ATOMIC WEIGHT 14.0056, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 60 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCTION	$\frac{h^2}{8\pi^2 I}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1} - \frac{h^2}{8\pi^2 I_2}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1} - \frac{h^2}{8\pi^2 I_2} - \frac{h^2}{8\pi^2 I_3}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1} - \frac{h^2}{8\pi^2 I_2} - \frac{h^2}{8\pi^2 I_3} - \frac{h^2}{8\pi^2 I_4}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1} - \frac{h^2}{8\pi^2 I_2} - \frac{h^2}{8\pi^2 I_3} - \frac{h^2}{8\pi^2 I_4} - \frac{h^2}{8\pi^2 I_5}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0} - \frac{h^2}{8\pi^2 I_1} - \frac{h^2}{8\pi^2 I_2} - \frac{h^2}{8\pi^2 I_3} - \frac{h^2}{8\pi^2 I_4} - \frac{h^2}{8\pi^2 I_5} - \frac{h^2}{8\pi^2 I_6}$	TEMP. (°K)
3000	1.0000	2.50000	20.3101	22.8101	4.96791	40.3995	45.3274	2.9422E 03	1.4904E 04	1.2100E 05
3200	1.0000	2.50000	20.4714	22.9714	4.96791	40.6001	45.6400	9.5384E 03	1.5097E 04	1.2610E 05
3400	1.0000	2.50000	20.6230	23.1230	4.96791	40.8113	45.9402	1.0133E 04	1.6091E 04	1.3034E 05
3600	1.0000	2.50000	20.7659	23.2659	4.96791	41.0253	46.2312	1.0731E 04	1.7084E 04	1.4025E 05
3800	1.0000	2.50000	20.9011	23.4011	4.96791	41.2339	46.5018	1.1327E 04	1.8078E 04	1.5078E 05
4000	1.0000	2.50000	21.0293	23.5293	4.96791	41.4387	46.7544	1.1923E 04	1.9072E 04	1.6113E 05
4200	1.0000	2.50000	21.1513	23.6513	4.96791	41.6311	46.9990	1.2519E 04	2.0064E 04	1.7135E 05
4400	1.0000	2.50000	21.2676	23.7676	4.96791	41.8222	47.2301	1.3115E 04	2.1054E 04	1.8148E 05
4600	1.0000	2.50000	21.3787	23.8787	4.96791	42.0114	47.4509	1.3711E 04	2.2042E 04	1.9152E 05
4800	1.0000	2.50000	21.4851	23.9851	4.96791	42.1994	47.6623	1.4308E 04	2.3028E 04	2.0147E 05
5000	1.0000	2.50000	21.5871	24.0871	4.96791	42.3872	47.8651	1.4904E 04	2.4014E 04	2.1134E 05
5200	1.0000	2.50000	21.6852	24.1852	4.96791	42.5729	48.0600	1.5500E 04	2.5000E 04	2.2113E 05
5400	1.0000	2.50000	21.7794	24.2794	4.96791	42.7566	48.2475	1.6096E 04	2.6000E 04	2.3084E 05
5600	1.0000	2.50000	21.8705	24.3705	4.96791	42.9382	48.4282	1.6692E 04	2.7000E 04	2.4056E 05
5800	1.0000	2.50001	21.9582	24.4582	4.96793	43.1184	48.6025	1.7288E 04	2.8000E 04	2.5028E 05
6000	1.0000	2.50001	22.0430	24.5430	4.96794	43.2969	48.7789	1.7885E 04	2.9000E 04	2.6000E 05
6200	1.0000	2.50002	22.1249	24.6250	4.96796	43.4736	48.9539	1.8481E 04	3.0000E 04	2.6972E 05
6400	1.0000	2.50004	22.2043	24.7043	4.96799	43.6484	49.1214	1.9077E 04	3.1000E 04	2.7944E 05
6600	1.0000	2.50006	22.2812	24.7813	4.96803	43.8216	49.2845	1.9673E 04	3.2000E 04	2.8916E 05
6800	1.0000	2.50008	22.3559	24.8560	4.96808	43.9934	49.4429	2.0269E 04	3.3000E 04	2.9888E 05
7000	1.0000	2.50012	22.4283	24.9285	4.96816	44.1636	49.5970	2.0865E 04	3.4000E 04	3.0860E 05
7200	1.0000	2.50018	22.4988	25.0000	4.96826	44.3324	49.7470	2.1461E 04	3.5000E 04	3.1832E 05
7400	1.0000	2.50025	22.5673	25.0675	4.96840	44.4999	49.8933	2.2057E 04	3.6000E 04	3.2804E 05
7600	1.0000	2.50034	22.6340	25.1343	4.96858	44.6674	49.9400	2.2653E 04	3.7000E 04	3.3776E 05
7800	1.0000	2.50046	22.6989	25.1994	4.96882	44.8344	50.0753	2.3249E 04	3.8000E 04	3.4748E 05
8000	1.0001	2.50061	22.7622	25.2628	4.96912	45.0014	50.2014	2.3845E 04	3.9000E 04	3.5720E 05
8200	1.0001	2.50079	22.8240	25.3245	4.96949	45.1684	50.3245	2.4441E 04	4.0000E 04	3.6692E 05
8400	1.0001	2.50103	22.8842	25.3852	4.96995	45.3353	50.4447	2.5037E 04	4.1000E 04	3.7664E 05
8600	1.0001	2.50131	22.9431	25.4444	4.97052	45.5017	50.5622	2.5633E 04	4.2000E 04	3.8636E 05
8800	1.0002	2.50165	23.0004	25.5022	4.97120	45.6676	50.6772	2.6229E 04	4.3000E 04	3.9608E 05
9000	1.0002	2.50207	23.0568	25.5589	4.97202	45.8332	50.7907	2.6825E 04	4.4000E 04	4.0580E 05
9200	1.0002	2.50256	23.1118	25.6144	4.97299	45.9977	50.9020	2.7421E 04	4.5000E 04	4.1552E 05
9400	1.0003	2.50313	23.1656	25.6688	4.97412	46.1613	51.0114	2.8017E 04	4.6000E 04	4.2524E 05
9600	1.0004	2.50379	23.2183	25.7221	4.97545	46.3243	51.1191	2.8613E 04	4.7000E 04	4.3496E 05
9800	1.0005	2.50456	23.2700	25.7745	4.97698	46.4868	51.2253	2.9209E 04	4.8000E 04	4.4468E 05
10000	1.0006	2.50545	23.3206	25.8260	4.97874	46.6488	51.3296	2.9805E 04	4.9000E 04	4.5440E 05
10500	1.0009	2.50822	23.4429	25.9511	4.98626	46.8049	51.5091	3.0401E 04	5.0000E 04	4.6412E 05
11000	1.0014	2.51193	23.5596	26.0716	4.99162	46.9569	51.6853	3.1000E 04	5.1000E 04	4.7384E 05
11500	1.0020	2.51672	23.6714	26.1881	5.00114	47.1050	51.8582	3.1600E 04	5.2000E 04	4.8356E 05
12000	1.0028	2.52274	23.7786	26.3014	5.01310	47.2521	52.0282	3.2200E 04	5.3000E 04	4.9328E 05
12500	1.0039	2.53012	23.8818	26.4119	5.02774	47.4000	52.1948	3.2800E 04	5.4000E 04	5.0300E 05
13000	1.0053	2.53806	23.9812	26.5201	5.04532	47.5544	52.3600	3.3400E 04	5.5000E 04	5.1272E 05
13500	1.0069	2.54655	24.0772	26.6265	5.06598	47.7153	52.5241	3.4000E 04	5.6000E 04	5.2244E 05
14000	1.0090	2.55617	24.1701	26.7315	5.08986	47.8826	52.6869	3.4600E 04	5.7000E 04	5.3216E 05
14500	1.0114	2.56704	24.2602	26.8353	5.11704	48.0561	52.8484	3.5200E 04	5.8000E 04	5.4188E 05

TABLE 16 (CONT.). IDEAL GAS FUNCTIONS FOR N<sub>2</sub>

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2}{RT}$	$\ln \frac{h^2}{RT}$	$\ln \frac{h^2}{RT} - \frac{h^2}{RT}$	$\ln \frac{h^2}{RT} - \frac{h^2}{RT} - \frac{h^2}{RT}$	$\ln \frac{h^2}{RT} - \frac{h^2}{RT} - \frac{h^2}{RT} - \frac{h^2}{RT}$	TEMP. (°K)							
15000	1.0142	2.59039	24.3478	24.9282	5.14754	48.3831	53.9304	4.74045	04	7.72135	04	7.25795	05	15000
15000	1.0175	2.60761	24.5350	27.0404	5.18134	48.5524	53.7357	4.92105	04	8.01115	04	7.52545	05	15000
16000	1.0213	2.62606	24.5161	27.1421	5.17842	48.7175	53.9359	5.17802	04	8.34795	04	7.79405	05	16000
16000	1.0255	2.64629	24.5972	27.2435	5.17452	48.8787	54.1373	5.39795	04	8.67875	04	8.06505	05	16000
17000	1.0304	2.66803	24.6765	27.3445	5.16971	49.0363	54.3361	5.63495	04	9.01315	04	8.33625	05	17000
17000	1.0357	2.69118	24.7542	27.4453	5.16487	49.1906	54.5304	5.91115	04	9.35875	04	8.60045	05	17000
18000	1.0417	2.71564	24.8303	27.5460	5.15998	49.3419	54.7304	6.20135	04	9.71345	04	8.86135	05	18000
18000	1.0482	2.74130	24.9041	27.6464	5.15494	49.4905	54.9379	6.50155	04	1.00705	05	9.15575	05	18000
19000	1.0554	2.76803	24.9785	27.7466	5.14975	49.6365	55.1370	6.81755	04	1.04515	05	9.45095	05	19000
19000	1.0631	2.79569	25.0508	27.8465	5.14441	49.7801	55.3356	7.14835	04	1.08335	04	9.76715	05	19000
20000	1.0715	2.82416	25.1219	27.9461	5.13894	49.9214	55.5335	7.50005	04	1.12245	05	1.00435	05	20000
20000	1.1112	2.94332	25.3946	28.1400	5.09481	50.4473	56.3162	8.49575	04	1.28605	05	1.11035	04	22000
24000	1.1610	3.06483	25.6580	28.3342	5.04903	50.9566	57.0769	9.86745	04	1.44175	05	1.22375	04	24000
24000	1.2204	3.18193	25.9079	28.5299	5.00299	51.4324	57.8044	1.12735	05	1.64405	05	1.33065	04	26000
28000	1.2688	3.29000	26.1478	28.7276	4.95676	51.8599	58.4977	1.27425	05	1.83065	05	1.45495	04	28000
30000	1.3056	3.38648	26.3781	28.9266	4.91000	52.2477	59.1672	1.42275	05	2.01805	05	1.57255	04	30000
32000	1.4500	3.67046	26.5946	29.1269	4.86237	52.6037	59.7538	1.57095	05	2.20605	05	1.69145	04	32000
34000	1.5412	3.84214	26.8120	29.3282	4.81482	52.9382	60.3108	1.71765	05	2.39325	05	1.81135	04	34000
36000	1.6307	3.99240	27.0163	29.5317	4.76735	53.2599	60.8443	1.86175	05	2.57715	05	1.93275	04	36000
38000	1.7167	4.12245	27.2126	29.7369	4.71999	53.5694	61.3536	2.00295	05	2.75815	05	2.05495	04	38000
40000	1.8006	4.24494	27.4008	29.9444	4.67277	53.8666	61.8390	2.14105	05	2.93595	05	2.17605	04	40000
42000	1.8824	4.36277	27.5819	30.1500	4.62566	54.1500	62.3011	2.27405	05	3.11045	05	2.29205	04	42000
44000	2.0790	4.57506	27.7559	30.3542	4.57864	54.4444	62.7415	2.40805	05	3.28245	05	2.40805	04	44000
46000	2.1993	4.77560	27.9233	30.5587	4.53171	54.7333	63.1682	2.53725	05	3.45135	05	2.52255	04	46000
48000	2.3228	4.96257	28.0843	30.7644	4.48494	55.0166	63.5817	2.66375	05	3.61795	05	2.63805	04	48000
50000	2.4494	5.14575	28.2394	30.9716	4.43837	55.2944	63.9811	2.78775	05	3.77735	05	2.75495	04	50000
60000	3.1180	6.03499	28.9364	32.7716	4.20755	57.5018	65.1226	3.38025	05	4.57255	05	3.45015	04	60000
70000	3.8318	7.03825	29.5281	33.3644	4.02724	58.6773	66.3045	3.94815	05	5.31915	05	4.10745	04	70000
80000	4.5828	8.14421	30.0409	33.8854	3.84607	59.8263	67.5364	4.52235	05	6.11215	05	4.77575	04	80000
90000	5.3758	9.36932	30.4950	34.3443	3.66898	60.9506	68.7205	5.13165	05	6.92015	05	5.45395	04	90000
100000	6.2242	10.71726	30.9049	34.8222	3.49825	62.0413	69.8675	5.79315	05	7.78435	05	6.16135	04	100000
120000	11.9275	14.33239	32.5690	36.9014	2.80911	64.7700	73.3291	9.43305	05	1.29145	06	9.70805	04	120000
140000	20.9740	24.84600	33.9526	38.3968	2.03365	67.2708	78.3044	1.40935	06	1.80675	06	1.84545	07	140000
160000	47.0546	43.30002	35.6744	40.0344	1.03444	70.8909	84.3444	2.59925	06	2.59925	06	2.12675	07	160000
180000	76.9378	63.05161	36.8955	40.9369	0.60082	73.2975	81.3484	2.82595	06	3.22035	06	2.93195	07	180000
200000	105.8050	83.80402	37.7617	41.5657	0.35922	75.0387	82.5979	2.78605	06	3.77945	06	3.75195	07	200000
400000	131.9011	131.9011	38.4379	42.0552	0.18818	76.3325	83.5707	3.12045	06	4.31295	06	4.58305	07	400000
600000	175.1500	175.1500	39.4408	42.8040	0.08326	78.3753	85.0586	3.75405	06	5.34445	06	6.27085	07	600000
1000000	208.4488	208.4488	40.1726	43.3739	0.04152	79.8297	86.1912	4.37445	06	6.36155	06	7.98305	07	1000000

TABLE 1. IDEAL GAS FUNCTIONS FOR  $\bar{u}$  30. (ATOMIC WEIGHT 15.9977,  $R = 1.98717$  CAL/MOLE) BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 61 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{H^2-E}{RT}$	$-\frac{E^2-E}{RT}$	$\delta H$	$10^3-\epsilon_2^{\text{CAL}}-\frac{10^3-\epsilon_2^{\text{EXPT}}}{\text{CAL/MOLE}}$	$\delta$	$E^2-E$	$\frac{H^2-E}{\text{CAL/MOLE}}$	$-(E^2-E)$	TEMP. (°K)
3000	5.3232	2.61572	22.1017	24.7974	5.19787	49.2760	9.8321E 03	1.5590E 04	1.3224E 05	3000
3200	5.3619	2.60896	22.3303	24.9593	5.18443	44.4137	1.0331E 04	1.6590E 04	1.6212E 05	3200
3400	5.3975	2.60294	22.5083	25.1112	5.17247	39.9002	1.0030E 04	1.7580E 04	1.5207E 05	3400
3600	5.4275	2.59755	22.6458	25.2545	5.16176	45.0230	1.1429E 04	1.8582E 04	1.4208E 05	3600
3800	5.4555	2.59269	22.7972	25.3899	5.15211	45.3018	1.2827E 04	1.9578E 04	1.3215E 05	3800
4000	5.4808	2.58829	22.9301	25.5184	5.14337	45.5659	1.4236E 04	2.0578E 04	1.2220E 05	4000
4200	5.5040	2.58429	23.0463	25.6406	5.13541	45.8166	1.5632E 04	2.1580E 04	1.1234E 05	4200
4400	5.5251	2.58064	23.1464	25.7570	5.12815	46.0594	1.7020E 04	2.2581E 04	1.0264E 05	4400
4600	5.5445	2.57728	23.2391	25.8683	5.12149	46.2932	1.8401E 04	2.3589E 04	9.2760E 05	4600
4800	5.5624	2.57420	23.3207	25.9749	5.11534	46.5010	1.9761E 04	2.4594E 04	8.2826E 05	4800
5000	5.5790	2.57135	23.3957	26.0770	5.10969	46.7097	2.1101E 04	2.5594E 04	7.2895E 05	5000
5200	5.5943	2.56871	23.4645	26.1752	5.10455	46.9100	2.2418E 04	2.6594E 04	6.2961E 05	5200
5400	5.6086	2.56626	23.5303	26.2697	5.09948	47.1026	2.3702E 04	2.7590E 04	5.3036E 05	5400
5600	5.6219	2.56398	23.5947	26.3607	5.09504	47.2879	2.4964E 04	2.8582E 04	4.3101E 05	5600
5800	5.6343	2.56185	23.6586	26.4484	5.09081	47.4667	2.6209E 04	2.9572E 04	3.3161E 05	5800
6000	5.6459	2.55985	23.7234	26.5333	5.08695	47.6392	2.7449E 04	3.0552E 04	2.3224E 05	6000
6200	5.6569	2.55798	23.7873	26.6153	5.08314	47.8059	2.8684E 04	3.1515E 04	1.3284E 05	6200
6400	5.6671	2.55623	23.8495	26.6948	5.07965	47.9672	2.9915E 04	3.2480E 04	3.0699E 05	6400
6600	5.6768	2.55458	23.9107	26.7717	5.07637	48.1235	3.1140E 04	3.3504E 04	3.1762E 05	6600
6800	5.6859	2.55302	23.9704	26.8464	5.07328	48.2750	3.2362E 04	3.4498E 04	3.2827E 05	6800
7000	5.6945	2.55155	24.0287	26.9189	5.07036	48.4220	3.3562E 04	3.5493E 04	3.3899E 05	7000
7200	5.7027	2.55017	24.0851	26.9894	5.06760	48.5640	3.4748E 04	3.6487E 04	3.4987E 05	7200
7400	5.7104	2.54886	24.1397	27.0580	5.06500	48.7034	3.5920E 04	3.7481E 04	3.6041E 05	7400
7600	5.7178	2.54761	24.1927	27.1257	5.06253	48.8387	3.7081E 04	3.8475E 04	3.7117E 05	7600
7800	5.7248	2.54644	24.2443	27.1897	5.06020	48.9701	3.8233E 04	3.9470E 04	3.8197E 05	7800
8000	5.7314	2.54533	24.2947	27.2530	5.05798	49.0982	3.9376E 04	4.0444E 04	3.9279E 05	8000
8200	5.7378	2.54427	24.3438	27.3148	5.05589	49.2231	4.0510E 04	4.1436E 04	4.0343E 05	8200
8400	5.7438	2.54327	24.3918	27.3751	5.05391	49.3449	4.1625E 04	4.2453E 04	4.1436E 05	8400
8600	5.7494	2.54235	24.4340	27.4340	5.05203	49.4638	4.2745E 04	4.3447E 04	4.2539E 05	8600
8800	5.7552	2.54144	24.4815	27.4915	5.05026	49.5799	4.3995E 04	4.4442E 04	4.3638E 05	8800
9000	5.7605	2.54060	24.5307	27.5478	5.04859	49.6934	4.5243E 04	4.5437E 04	4.4724E 05	9000
9200	5.7656	2.53981	24.5830	27.6028	5.04701	49.8043	4.6491E 04	4.6433E 04	4.5820E 05	9200
9400	5.7704	2.53906	24.6376	27.6567	5.04553	49.9129	4.7742E 04	4.7429E 04	4.6918E 05	9400
9600	5.7751	2.53837	24.6917	27.7094	5.04415	50.0191	4.9003E 04	4.8424E 04	4.8018E 05	9600
9800	5.7797	2.53772	24.7461	27.7611	5.04286	50.1231	5.0266E 04	4.9420E 04	4.9121E 05	9800
10000	5.7841	2.53712	24.7947	27.8119	5.04167	50.2249	5.1543E 04	5.0417E 04	5.0225E 05	10000
10500	5.7943	2.53582	24.9364	27.9342	5.03949	50.4709	5.3951E 04	5.2918E 04	5.2994E 05	10500
11000	5.8039	2.53483	25.0512	28.0512	5.03712	50.7052	5.6550E 04	5.5408E 04	5.5776E 05	11000
11500	5.8128	2.53415	25.1490	28.1632	5.03577	50.9291	5.9249E 04	5.7911E 04	5.8586E 05	11500
12000	5.8212	2.53378	25.2369	28.2707	5.03507	51.1434	6.2017E 04	6.0421E 04	6.1372E 05	12000
12500	5.8292	2.53370	25.3043	28.3741	5.03504	51.3490	6.4890E 04	6.2938E 04	6.4186E 05	12500
13000	5.8378	2.53413	25.3597	28.4738	5.03573	51.5464	6.7841E 04	6.5464E 04	6.7010E 05	13000
13500	5.8466	2.53466	25.4093	28.5702	5.03716	51.7365	7.0857E 04	6.8002E 04	6.9844E 05	13500
14000	5.8521	2.53595	25.4575	28.6635	5.03935	51.9197	7.3931E 04	7.0551E 04	7.2648E 05	14000
14500	5.8596	2.53745	25.5023	28.7540	5.04232	52.0964	7.7119E 04	7.3114E 04	7.5540E 05	14500





TABLE 18. IDEAL GAS FUNCTIONS FOR AR 3+ (ATOMIC WEIGHT 39.9440, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 62 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT- FUNCT.	$\frac{h^2 E}{RT}$	$-\frac{h^2 E}{RT}$	$\ln \frac{h^2 E}{RT}$	$-\ln \frac{h^2 E}{RT}$	$\ln \frac{h^2 E}{RT}$	$-\ln \frac{h^2 E}{RT}$	$\ln \frac{h^2 E}{RT}$	$-\ln \frac{h^2 E}{RT}$	TEMP. (°K)
3000	4.0004	2.50099	23.2406	25.7496	4.96908	46.2307	51.2609	0.9402E 03	1.4916E 04	1.372E 05
3200	4.0007	2.50175	23.4301	25.9318	4.97150	46.5394	51.5308	1.5495E 03	1.5908E 04	1.4699E 05
3400	4.0013	2.50280	23.5818	26.0847	4.97346	46.8409	51.8446	1.6134E 04	1.6910E 04	1.5933E 05
3600	4.0021	2.50459	23.7254	26.2294	4.97465	47.1453	52.1221	1.6763E 04	1.7917E 04	1.6972E 05
3800	4.0033	2.50645	23.8604	26.3670	4.98114	47.4465	52.3956	1.7377E 04	1.8920E 04	1.8017E 05
4000	4.0050	2.50945	23.9900	26.4984	4.98648	47.7471	52.6548	1.7988E 04	1.9943E 04	1.9064E 05
4200	4.0071	2.51295	24.1115	26.6245	4.99344	48.0481	52.9072	1.8617E 04	2.0972E 04	2.0124E 05
4400	4.0099	2.51721	24.2285	26.7457	5.00121	48.3494	53.1602	1.9266E 04	2.2009E 04	2.1184E 05
4600	4.0134	2.52227	24.3405	26.8628	5.00986	48.6510	53.4146	1.9938E 04	2.3054E 04	2.2250E 05
4800	4.0177	2.52817	24.4480	26.9761	5.01939	48.9539	53.6701	2.0632E 04	2.4115E 04	2.3319E 05
5000	4.0229	2.53491	24.5513	27.0862	5.02978	49.2582	53.9268	2.1351E 04	2.5184E 04	2.4394E 05
5200	4.0290	2.54249	24.6509	27.1934	5.04104	49.5644	54.1846	2.2093E 04	2.6272E 04	2.5472E 05
5400	4.0361	2.55090	24.7470	27.2979	5.05318	49.8724	54.4444	2.2856E 04	2.7373E 04	2.6555E 05
5600	4.0442	2.56012	24.8399	27.4000	5.06618	50.1824	54.7064	2.3642E 04	2.8486E 04	2.7642E 05
5800	4.0535	2.57011	24.9299	27.5001	5.08004	50.4944	54.9704	2.4451E 04	2.9622E 04	2.8733E 05
6000	4.0638	2.58084	25.0172	27.5981	5.09478	50.8084	55.2364	2.5282E 04	3.0771E 04	2.9828E 05
6200	4.0754	2.59225	25.1021	27.6943	5.11032	51.1244	55.4944	2.6135E 04	3.1938E 04	3.0927E 05
6400	4.0881	2.60429	25.1845	27.7888	5.12665	51.4424	55.7564	2.7009E 04	3.3121E 04	3.2029E 05
6600	4.1020	2.61691	25.2649	27.8818	5.14378	51.7624	56.0224	2.7898E 04	3.4321E 04	3.3134E 05
6800	4.1172	2.63004	25.3432	27.9732	5.16151	52.0844	56.2924	2.8804E 04	3.5533E 04	3.4244E 05
7000	4.1335	2.64363	25.4196	28.0633	5.17984	52.4084	56.5664	2.9726E 04	3.6773E 04	3.5359E 05
7200	4.1511	2.65762	25.4943	28.1519	5.19878	52.7344	56.8444	3.0664E 04	3.8042E 04	3.6494E 05
7400	4.1699	2.67214	25.5673	28.2393	5.21832	53.0624	57.1264	3.1618E 04	3.9341E 04	3.7642E 05
7600	4.1898	2.68724	25.6388	28.3253	5.23846	53.3924	57.4224	3.2598E 04	4.0672E 04	3.8794E 05
7800	4.2110	2.70296	25.7087	28.4101	5.25920	53.7244	57.7224	3.3609E 04	4.2038E 04	3.9944E 05
8000	4.2333	2.71933	25.7773	28.4936	5.28064	54.0584	58.0264	3.4644E 04	4.3438E 04	4.1094E 05
8200	4.2568	2.73641	25.8446	28.5760	5.30278	54.3944	58.3344	3.5694E 04	4.4872E 04	4.2244E 05
8400	4.2813	2.75425	25.9106	28.6571	5.32562	54.7324	58.6464	3.6758E 04	4.6342E 04	4.3394E 05
8600	4.3070	2.77289	25.9754	28.7371	5.34916	55.0724	58.9624	3.7836E 04	4.7842E 04	4.4544E 05
8800	4.3338	2.79230	26.0390	28.8158	5.37340	55.4144	59.2824	3.8928E 04	4.9372E 04	4.5694E 05
9000	4.3615	2.81253	26.1016	28.8934	5.39834	55.7584	59.6064	4.0034E 04	5.0932E 04	4.6844E 05
9200	4.3903	2.83367	26.1631	28.9699	5.42398	56.1044	59.9344	4.1154E 04	5.2522E 04	4.7994E 05
9400	4.4201	2.85571	26.2237	29.0451	5.45032	56.4524	60.2664	4.2288E 04	5.4142E 04	4.9144E 05
9600	4.4509	2.87866	26.2832	29.1193	5.47736	56.8024	60.6024	4.3468E 04	5.5792E 04	5.0294E 05
9800	4.4824	2.90242	26.3418	29.1923	5.50500	57.1544	60.9424	4.4664E 04	5.7472E 04	5.1444E 05
10000	4.5149	2.92694	26.3994	29.2641	5.53324	57.5084	61.2864	4.5874E 04	5.9182E 04	5.2594E 05
10500	4.5997	2.99844	26.5402	29.4388	5.60578	58.1624	61.9424	4.7524E 04	6.1442E 04	5.5244E 05
11000	4.6893	3.07082	26.6758	29.6066	5.67942	58.8184	62.6004	4.9194E 04	6.3702E 04	5.7894E 05
11500	4.7832	3.14506	26.8067	29.7676	5.75416	59.4764	63.2604	5.0884E 04	6.5962E 04	6.0544E 05
12000	4.8809	3.22127	26.9333	29.9221	5.82990	60.1364	63.9224	5.2594E 04	6.8222E 04	6.3194E 05
12500	4.9919	3.30049	27.0559	30.0702	5.90674	60.7984	64.5864	5.4324E 04	7.0482E 04	6.5844E 05
13000	5.0958	3.38177	27.1745	30.2123	5.98468	61.4624	65.2524	5.6074E 04	7.2742E 04	6.8494E 05
13500	5.1921	3.46504	27.2896	30.3485	6.06372	62.1284	65.9184	5.7844E 04	7.5002E 04	7.1144E 05
14000	5.2904	3.55031	27.4012	30.4792	6.14386	62.7964	66.5864	5.9624E 04	7.7262E 04	7.3794E 05
14500	5.3910	3.63759	27.5095	30.6046	6.22500	63.4664	67.2564	6.1424E 04	7.9522E 04	7.6444E 05

TABLE 10 (CONT.). IDEAL GAS FUNCTIONS FOR AIR 34

TEMP. (°F)	PARTIAL PRESS.	$\frac{W}{L} - \frac{P}{L}$ BT	DR	$10^6 - \frac{C}{L} - \frac{D}{L}$ CAL/MIN/IN	$10^6 - \frac{C}{L} - \frac{D}{L}$ CAL/MIN/IN	$10^6 - \frac{C}{L} - \frac{D}{L}$ CAL/MIN/IN	TEMP. (°F)
13000	5.5226	3.11027	27.6157	30.7250	6.10062	54.0781	61.0554
13500	5.6355	3.12367	27.77169	30.6666	6.20725	55.0781	61.2893
14000	5.7493	3.13542	27.91813	30.5917	6.23061	55.2755	61.5061
14500	5.8637	3.14544	27.91129	31.0586	6.25094	55.4676	61.7105
15000	5.9786	3.15450	28.00070	31.1614	6.26891	55.6544	61.9230
15500	6.0938	3.16291	28.09095	31.2604	6.28354	55.8344	62.1199
16000	6.2091	3.16987	28.1877	31.3581	6.29628	56.0136	62.3098
16500	6.3244	3.17633	28.2766	31.4484	6.30803	56.1862	62.4932
17000	6.4394	3.18234	28.3593	31.5375	6.31870	56.3545	62.6702
17500	6.5542	3.18781	28.4419	31.6237	6.32870	56.5187	62.8415
18000	6.6686	3.19282	28.5225	31.7071	6.33837	56.6788	63.0072
18500	6.7829	3.19740	28.6023	31.7878	6.34769	56.8346	63.1674
19000	6.8968	3.20164	28.6810	31.8659	6.35665	56.9865	63.3224
19500	7.0101	3.20554	28.7587	31.9415	6.36525	57.1346	63.4726
20000	7.1228	3.20910	28.8353	32.0146	6.37349	57.2784	63.6181
20500	7.2350	3.21233	28.9108	32.0851	6.38137	57.4184	63.7592
21000	7.3467	3.21524	28.9853	32.1530	6.38889	57.5549	63.8959
21500	7.4579	3.21783	29.0588	32.2183	6.39605	57.6881	64.0284
22000	7.5686	3.22010	29.1313	32.2810	6.40285	57.8184	64.1568
22500	7.6788	3.22205	29.2028	32.3411	6.40929	57.9461	64.2812
23000	7.7885	3.22369	29.2733	32.3986	6.41537	58.0715	64.4026
23500	7.8977	3.22502	29.3428	32.4535	6.42109	58.1948	64.5209
24000	8.0064	3.22605	29.4113	32.5058	6.42645	58.3161	64.6362
24500	8.1146	3.22678	29.4788	32.5555	6.43145	58.4354	64.7485
25000	8.2222	3.22721	29.5453	32.6026	6.43609	58.5528	64.8578
25500	8.3293	3.22734	29.6108	32.6471	6.44037	58.6684	64.9641
26000	8.4359	3.22717	29.6753	32.6890	6.44429	58.7822	65.0674
26500	8.5420	3.22670	29.7388	32.7283	6.44785	58.8943	65.1687
27000	8.6476	3.22593	29.8013	32.7650	6.45105	59.0048	65.2679
27500	8.7527	3.22486	29.8628	32.7991	6.45389	59.1137	65.3650
28000	8.8573	3.22349	29.9233	32.8306	6.45637	59.2210	65.4600
28500	8.9614	3.22182	29.9828	32.8595	6.45849	59.3268	65.5530
29000	9.0650	3.21985	30.0413	32.8858	6.46025	59.4311	65.6449
29500	9.1681	3.21758	30.0988	32.9095	6.46165	59.5340	65.7348
30000	9.2707	3.21501	30.1553	32.9306	6.46269	59.6354	65.8226
30500	9.3728	3.21214	30.2108	32.9491	6.46337	59.7354	65.9084
31000	9.4744	3.20897	30.2653	32.9650	6.46369	59.8339	66.0000
31500	9.5755	3.20550	30.3188	32.9783	6.46365	59.9309	66.0884
32000	9.6761	3.20173	30.3713	32.9891	6.46325	60.0264	66.1736
32500	9.7762	3.19775	30.4228	32.9974	6.4		

TABLE 19. IDEAL GAS FUNCTIONS FOR C 4+ (ATOMIC WEIGHT 12.0099, R = 1.987.7 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS n ≤ 6. SEE TABLE 43 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{U^0 - U^0}{RT}$	$\frac{U^0 - U^0}{RT}$	$\frac{U^0 - U^0}{RT}$	$\frac{U^0 - U^0}{RT}$	$\frac{U^0 - U^0}{RT}$	$\frac{U^0 - U^0}{RT}$	$\frac{U^0 - U^0}{RT}$	$\frac{U^0 - U^0}{RT}$	$\frac{U^0 - U^0}{RT}$	$\frac{U^0 - U^0}{RT}$	TEMP. (°K)
5000	1.0000	2.50000	21.3565	23.8565	4.96791	42.4399	47.4068	1.4904E 04	2.4040E 04	2.4040E 04	2.1219E 05	5000
5200	1.0000	2.50000	21.4546	23.9546	4.96791	42.5318	47.6017	1.5000E 04	2.5000E 04	2.5000E 04	2.2170E 05	5200
5400	1.0000	2.50000	21.5489	24.0489	4.96791	42.6212	47.7892	1.6094E 04	2.6094E 04	2.6094E 04	2.3123E 05	5400
5600	1.0000	2.50000	21.6398	24.1398	4.96791	42.7089	47.9698	1.6872E 04	2.7872E 04	2.7872E 04	2.4081E 05	5600
5800	1.0000	2.50000	21.7276	24.2276	4.96791	42.7942	48.1442	1.7780E 04	2.8814E 04	2.8814E 04	2.5042E 05	5800
6000	1.0000	2.50000	21.8123	24.3123	4.96791	42.8767	48.3126	1.7884E 04	2.9007E 04	2.9007E 04	2.6007E 05	6000
6200	1.0000	2.50000	21.8943	24.3943	4.96791	42.9576	48.4795	1.8481E 04	3.0001E 04	3.0001E 04	2.6973E 05	6200
6400	1.0000	2.50000	21.9737	24.4737	4.96791	43.0365	48.6332	1.9077E 04	3.1179E 04	3.1179E 04	2.7944E 05	6400
6600	1.0000	2.50000	22.0506	24.5506	4.96791	43.1132	48.7861	1.9673E 04	3.2708E 04	3.2708E 04	2.8920E 05	6600
6800	1.0000	2.50000	22.1252	24.6252	4.96791	43.1885	48.9344	2.0269E 04	3.3782E 04	3.3782E 04	2.9897E 05	6800
7000	1.0000	2.50000	22.1977	24.6977	4.96791	43.2619	49.0784	2.0865E 04	3.4775E 04	3.4775E 04	3.0877E 05	7000
7200	1.0000	2.50000	22.2681	24.7681	4.96791	43.3334	49.2183	2.1461E 04	3.5768E 04	3.5768E 04	3.1860E 05	7200
7400	1.0000	2.50000	22.3364	24.8364	4.96791	43.4035	49.3545	2.2058E 04	3.6761E 04	3.6761E 04	3.2846E 05	7400
7600	1.0000	2.50000	22.4033	24.9033	4.96791	43.4719	49.4869	2.2654E 04	3.7754E 04	3.7754E 04	3.3834E 05	7600
7800	1.0000	2.50000	22.4682	24.9682	4.96791	43.5388	49.6160	2.3250E 04	3.8750E 04	3.8750E 04	3.4825E 05	7800
8000	1.0000	2.50000	22.5315	25.0315	4.96791	43.6044	49.7418	2.3844E 04	3.9743E 04	3.9743E 04	3.5819E 05	8000
8200	1.0000	2.50000	22.5932	25.0932	4.96791	43.6686	49.8644	2.4442E 04	4.0737E 04	4.0737E 04	3.6815E 05	8200
8400	1.0000	2.50000	22.6533	25.1533	4.96791	43.7312	49.9841	2.5038E 04	4.1730E 04	4.1730E 04	3.7814E 05	8400
8600	1.0000	2.50000	22.7123	25.2123	4.96791	43.7925	50.1010	2.5634E 04	4.2724E 04	4.2724E 04	3.8814E 05	8600
8800	1.0000	2.50000	22.7698	25.2698	4.96791	43.8525	50.2153	2.6231E 04	4.3718E 04	4.3718E 04	3.9818E 05	8800
9000	1.0000	2.50000	22.8260	25.3260	4.96791	43.9110	50.3269	2.6827E 04	4.4711E 04	4.4711E 04	4.0823E 05	9000
9200	1.0000	2.50000	22.8809	25.3809	4.96791	43.9682	50.4361	2.7423E 04	4.5702E 04	4.5702E 04	4.1831E 05	9200
9400	1.0000	2.50000	22.9347	25.4347	4.96791	44.0240	50.5429	2.8019E 04	4.6690E 04	4.6690E 04	4.2841E 05	9400
9600	1.0000	2.50000	22.9873	25.4873	4.96791	44.0785	50.6475	2.8615E 04	4.7672E 04	4.7672E 04	4.3852E 05	9600
9800	1.0000	2.50000	23.0389	25.5389	4.96791	44.1316	50.7500	2.9211E 04	4.8664E 04	4.8664E 04	4.4864E 05	9800
10000	1.0000	2.50000	23.0894	25.5894	4.96791	44.1834	50.8503	2.9807E 04	4.9679E 04	4.9679E 04	4.5882E 05	10000
10500	1.0000	2.50000	23.2113	25.7113	4.96791	44.2348	51.0227	3.1208E 04	5.2163E 04	5.2163E 04	4.8431E 05	10500
11000	1.0000	2.50000	23.3276	25.8276	4.96791	44.2859	51.1928	3.2708E 04	5.4647E 04	5.4647E 04	5.0971E 05	11000
11500	1.0000	2.50000	23.4388	25.9388	4.96791	44.3367	51.3546	3.4279E 04	5.7131E 04	5.7131E 04	5.3503E 05	11500
12000	1.0000	2.50000	23.5452	26.0452	4.96791	44.3862	51.5081	3.5769E 04	5.9615E 04	5.9615E 04	5.6144E 05	12000
12500	1.0000	2.50000	23.6472	26.1472	4.96791	44.4350	51.6589	3.7259E 04	6.2099E 04	6.2099E 04	5.8799E 05	12500
13000	1.0000	2.50000	23.7453	26.2453	4.96791	44.4835	51.8058	3.8750E 04	6.4583E 04	6.4583E 04	6.1342E 05	13000
13500	1.0000	2.50000	23.8396	26.3396	4.96791	44.5317	51.9482	4.0240E 04	6.7067E 04	6.7067E 04	6.3954E 05	13500
14000	1.0000	2.50000	23.9306	26.4306	4.96791	44.5796	52.0862	4.1730E 04	6.9551E 04	6.9551E 04	6.6570E 05	14000
14500	1.0000	2.50000	24.0183	26.5183	4.96791	44.6273	52.2283	4.3221E 04	7.2035E 04	7.2035E 04	6.9206E 05	14500
15000	1.0000	2.50000	24.1030	26.6030	4.96791	44.6747	52.3644	4.4711E 04	7.4519E 04	7.4519E 04	7.1849E 05	15000
15500	1.0000	2.50000	24.1850	26.6850	4.96791	44.7218	53.0275	4.6202E 04	7.7003E 04	7.7003E 04	7.4492E 05	15500
16000	1.0000	2.50000	24.2644	26.7644	4.96791	44.7685	53.1853	4.7692E 04	7.9487E 04	7.9487E 04	7.7144E 05	16000
16500	1.0000	2.50000	24.3413	26.8413	4.96791	44.8148	53.3381	4.9182E 04	8.1971E 04	8.1971E 04	7.9811E 05	16500
17000	1.0000	2.50000	24.4159	26.9159	4.96791	44.8604	53.4864	5.0673E 04	8.4455E 04	8.4455E 04	8.2481E 05	17000
17500	1.0000	2.50000	24.4884	26.9884	4.96791	44.9055	53.6304	5.2163E 04	8.6938E 04	8.6938E 04	8.5159E 05	17500
18000	1.0000	2.50000	24.5588	27.0588	4.96791	44.9502	53.7704	5.3653E 04	8.9422E 04	8.9422E 04	8.7844E 05	18000
18500	1.0000	2.50000	24.6273	27.1273	4.96791	44.9946	53.9065	5.5144E 04	9.1906E 04	9.1906E 04	9.0534E 05	18500
19000	1.0000	2.50000	24.6940	27.1940	4.96791	45.0388	54.0390	5.6634E 04	9.4390E 04	9.4390E 04	9.3233E 05	19000
19500	1.0000	2.50000	24.7589	27.2589	4.96791	45.0821	54.1680	5.8123E 04	9.6874E 04	9.6874E 04	9.5940E 05	19500

TABLE 19 (CONT.). IDEAL GAS FUNCTIONS FOR C<sub>4</sub>

TEMP. (°K)	PARTIAL FUNCT.	$\frac{H^0 - E^0}{RT}$	$-\frac{S^0 - E^0}{RT}$	$\ln \frac{H^0 - E^0}{RT}$	$\ln \frac{H^0 - E^0}{RT} - \frac{S^0 - E^0}{RT}$	$\ln \frac{H^0 - E^0}{RT} - \frac{S^0 - E^0}{RT}$	$\ln \frac{H^0 - E^0}{RT} - \frac{S^0 - E^0}{RT}$	$\ln \frac{H^0 - E^0}{RT} - \frac{S^0 - E^0}{RT}$	TEMP. (°K)
20000	1.0000	2.50000	24.8222	4.96791	49.3259	54.2938	5.9615E 04	9.9358E 04	20000
22000	1.0000	2.50000	25.0605	4.96791	49.7994	54.7673	5.9517E 04	9.9358E 04	22000
24000	1.0000	2.50000	25.2780	4.96791	50.2317	55.1996	5.9418E 04	9.9358E 04	24000
26000	1.0000	2.50000	25.4782	4.96791	50.6293	55.5972	5.9319E 04	9.9358E 04	26000
28000	1.0000	2.50000	25.6634	4.96791	50.9975	55.9654	5.9220E 04	9.9358E 04	28000
30000	1.0000	2.50000	25.8359	4.96791	51.3402	56.3081	5.9121E 04	9.9358E 04	30000
32000	1.0000	2.50000	25.9973	4.96791	51.6608	56.6288	5.9022E 04	9.9358E 04	32000
34000	1.0000	2.50000	26.1488	4.96791	51.9620	56.9299	5.8923E 04	9.9358E 04	34000
36000	1.0000	2.50000	26.2917	4.96791	52.2460	57.2139	5.8824E 04	9.9358E 04	36000
38000	1.0000	2.50000	26.4269	4.96791	52.5146	57.4825	5.8725E 04	9.9358E 04	38000
40000	1.0000	2.50000	26.5551	4.96791	52.7694	57.7373	5.8626E 04	9.9358E 04	40000
42000	1.0000	2.50000	26.6771	4.96791	53.0118	57.9797	5.8527E 04	9.9358E 04	42000
44000	1.0000	2.50000	26.7934	4.96791	53.2429	58.2108	5.8428E 04	9.9358E 04	44000
46000	1.0000	2.50000	26.9045	4.96791	53.4637	58.4316	5.8329E 04	9.9358E 04	46000
48000	1.0000	2.50000	27.0109	4.96791	53.6752	58.6431	5.8230E 04	9.9358E 04	48000
50000	1.0000	2.50000	27.1130	4.96791	53.8780	58.8459	5.8131E 04	9.9358E 04	50000
60000	1.0000	2.50000	27.5688	4.96791	54.7837	59.7516	5.7632E 04	9.9358E 04	60000
70000	1.0000	2.50000	27.9541	4.96791	55.5495	60.5174	5.7133E 04	9.9358E 04	70000
80000	1.0000	2.50000	28.2880	4.96791	56.2129	61.1808	5.6634E 04	9.9358E 04	80000
90000	1.0000	2.50000	28.5824	4.96791	56.7980	61.7659	5.6135E 04	9.9358E 04	90000
100000	1.0000	2.50000	28.8458	4.96791	57.3214	62.2894	5.5636E 04	9.9358E 04	100000
150000	1.0000	2.50000	29.8995	4.96791	59.3358	64.3037	5.4637E 04	9.9358E 04	150000
200000	1.0000	2.50000	30.5187	4.96791	60.7649	65.7329	5.4138E 04	9.9358E 04	200000
300000	1.0002	2.50257	31.5926	4.97302	62.7797	67.7527	5.3639E 04	9.9358E 04	300000
400000	1.0050	2.50409	32.3165	5.06348	64.2183	69.2818	5.3140E 04	9.9358E 04	400000
500000	1.0352	2.76861	32.9041	5.50163	65.3858	70.4475	5.2641E 04	9.9358E 04	500000
600000	1.1321	3.27455	33.4493	6.30787	66.4654	71.5272	5.2142E 04	9.9358E 04	600000
800000	1.7016	4.57624	34.5760	9.09454	68.7082	73.7608	5.1143E 04	9.9358E 04	800000
1000000	2.9272	5.16922	35.6763	10.27209	70.8948	75.9235	5.0644E 04	9.9358E 04	1000000
1500000	6.4832	4.90217	37.7541	42.6562	9.74143	75.0235	5.0145E 04	9.9358E 04	1500000
2000000	15.8002	4.41968	39.0952	43.5149	8.76264	77.6886	4.9646E 04	9.9358E 04	2000000
3000000	30.3378	3.82347	40.7612	44.5867	7.60184	80.9993	4.9147E 04	9.9358E 04	3000000
4000000	42.3389	3.50524	41.8137	45.3190	6.96548	83.0908	4.8648E 04	9.9358E 04	4000000
5000000	51.7954	3.30846	42.5732	45.6817	6.74445	84.6000	4.8149E 04	9.9358E 04	5000000
6000000	59.2790	3.17578	43.1640	46.3397	6.51081	85.7739	4.7650E 04	9.9358E 04	6000000
8000000	70.2102	3.00856	44.0524	47.0410	5.97850	87.5394	4.7151E 04	9.9358E 04	8000000
10000000	77.7344	2.90759	44.7121	47.6196	5.77785	88.8503	4.6652E 04	9.9358E 04	10000000

TABLE 20. IDEAL GAS FUNCTIONS FOR N<sub>2</sub> (INTRINSIC HEIGHT 14.0045, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N=4. SEE TABLE 64 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	TEMP. (°K)
9000	2.0000	22.7802	24.7402	4.96791	44.2745	1.4904E 04	2.4840E 04	2.2137E 05	5000
9200	2.0000	22.7783	24.8783	4.96791	44.4694	1.5000E 04	2.5833E 04	2.3124E 05	5200
9400	2.0000	22.7726	24.9726	4.96791	44.6559	1.5098E 04	2.6821E 04	2.4115E 05	5400
9600	2.0000	22.7638	25.0535	4.96791	44.8375	1.5198E 04	2.7820E 04	2.5109E 05	5600
9800	2.0000	22.7513	25.1513	4.96791	45.0119	1.5298E 04	2.8814E 04	2.6107E 05	5800
6000	2.0000	22.7360	25.2360	4.96791	45.1803	1.5398E 04	2.9807E 04	2.7108E 05	6000
6200	2.0000	22.7180	25.3180	4.96791	45.3432	1.5498E 04	3.0801E 04	2.8113E 05	6200
6400	2.0000	22.6974	25.3974	4.96791	45.5009	1.5598E 04	3.1795E 04	2.9121E 05	6400
6600	2.0000	22.6743	25.4743	4.96792	45.6538	1.5698E 04	3.2782E 04	3.0131E 05	6600
6800	2.0000	22.6490	25.5490	4.96792	45.8021	2.0269E 04	3.3782E 04	3.1145E 05	6800
7000	2.0000	22.6214	25.6214	4.96792	45.9461	2.0859E 04	3.4775E 04	3.2162E 05	7000
7200	2.0000	22.5919	25.6919	4.96792	46.0860	2.1461E 04	3.5769E 04	3.3182E 05	7200
7400	2.0000	22.5603	25.7603	4.96793	46.2222	2.2084E 04	3.6763E 04	3.4204E 05	7400
7600	2.0000	22.5270	25.8270	4.96793	46.3546	2.2654E 04	3.7756E 04	3.5230E 05	7600
7800	2.0000	22.4920	25.8920	4.96793	46.4837	2.3250E 04	3.8750E 04	3.6267E 05	7800
8000	2.0000	22.4553	25.9553	4.96796	46.6095	2.3866E 04	3.9744E 04	3.7288E 05	8000
8200	2.0000	22.4170	26.0170	4.96797	46.7321	2.4493E 04	4.0737E 04	3.8320E 05	8200
8400	2.0000	22.3772	26.0773	4.96800	46.8519	2.5132E 04	4.1731E 04	3.9364E 05	8400
8600	2.0000	22.3361	26.1361	4.96802	46.9688	2.5783E 04	4.2725E 04	4.0393E 05	8600
8800	2.0000	22.2935	26.1936	4.96806	47.0830	2.6446E 04	4.3719E 04	4.1433E 05	8800
9000	2.0000	22.2497	26.2498	4.96811	47.1946	2.7122E 04	4.4713E 04	4.2475E 05	9000
9200	2.0000	22.2047	26.3048	4.96816	47.3038	2.7812E 04	4.5707E 04	4.3520E 05	9200
9400	2.0000	22.1584	26.3586	4.96823	47.4107	2.8516E 04	4.6701E 04	4.4566E 05	9400
9600	2.0000	22.1111	26.4113	4.96832	47.5153	2.9234E 04	4.7696E 04	4.5615E 05	9600
9800	2.0000	22.0626	26.4629	4.96842	47.6177	2.9967E 04	4.8691E 04	4.6665E 05	9800
10000	2.0000	22.0131	26.5135	4.96855	47.7181	3.0716E 04	4.9669E 04	4.7718E 05	10000
10500	2.0001	21.9351	26.6357	4.96896	47.9605	3.1309E 04	5.0647E 04	4.8771E 05	10500
11000	2.0002	21.8515	26.7523	4.96926	48.1917	3.1908E 04	5.1624E 04	4.9811E 05	11000
11500	2.0002	21.7626	26.8639	4.97041	48.4126	3.2513E 04	5.2601E 04	5.0847E 05	11500
12000	2.0004	21.6691	26.9709	4.97156	48.6242	3.3133E 04	5.3585E 04	5.1879E 05	12000
12500	2.0006	21.5712	27.0738	4.97306	48.8271	3.3768E 04	5.4576E 04	5.2914E 05	12500
13000	2.0008	21.4694	27.1730	4.97499	49.0222	3.4418E 04	5.5574E 04	5.3954E 05	13000
13500	2.0011	21.3639	27.2687	4.97740	49.2100	3.5083E 04	5.6579E 04	5.5000E 05	13500
14000	2.0015	21.2550	27.3613	4.98034	49.3911	3.5763E 04	5.7591E 04	5.6054E 05	14000
14500	2.0020	21.1430	27.4511	4.98388	49.5659	3.6456E 04	5.8610E 04	5.7117E 05	14500
15000	2.0026	21.0281	27.5382	4.98806	49.7349	3.7163E 04	5.9636E 04	5.8196E 05	15000
15500	2.0034	20.9104	27.6230	4.99292	49.8966	3.7884E 04	6.0669E 04	5.9288E 05	15500
16000	2.0043	20.7899	27.7056	4.99851	50.0572	3.8619E 04	6.1719E 04	6.0391E 05	16000
16500	2.0053	20.6667	27.7853	5.00485	50.2111	3.9368E 04	6.2786E 04	6.1506E 05	16500
17000	2.0065	20.5429	27.8629	5.01198	50.3606	4.0131E 04	6.3869E 04	6.2636E 05	17000
17500	2.0079	20.4181	27.9382	5.01990	50.5060	4.0908E 04	6.4969E 04	6.3781E 05	17500
18000	2.0095	20.2923	28.0123	5.02863	50.6475	4.1700E 04	6.6086E 04	6.4941E 05	18000
18500	2.0113	20.1657	28.0851	5.03816	50.7854	4.2506E 04	6.7219E 04	6.6136E 05	18500
19000	2.0134	20.0385	28.1569	5.04851	50.9199	4.3326E 04	6.8369E 04	6.7356E 05	19000
19500	2.0156	19.9105	28.2276	5.05965	51.0512	4.4160E 04	6.9536E 04	6.8591E 05	19500

TABLE 20 (C.C.I.). IDEAL GAS FUNCTIONS FOR H<sub>2</sub>

TEMP. (°K)	PARTIAL PRESSURE (atm)	$\frac{h^2}{RT}$	$\frac{h^2}{RT} - \frac{h^2}{RT_0}$	$\ln \frac{h^2}{RT} - \ln \frac{h^2}{RT_0}$	$\ln \frac{h^2}{RT} - \ln \frac{h^2}{RT_0} - \frac{h^2}{RT_0}$	$\ln \frac{h^2}{RT} - \ln \frac{h^2}{RT_0} - \frac{h^2}{RT_0} - \frac{h^2}{RT_0}$	$\ln \frac{h^2}{RT} - \ln \frac{h^2}{RT_0} - \frac{h^2}{RT_0} - \frac{h^2}{RT_0} - \frac{h^2}{RT_0}$	TEMP. (°K)
2000	2.0181	2.55216	2.55216	5.07157	51.1795	56.2510	6.1808E 04	20000
2200	2.0308	2.57995	2.57995	5.12660	51.6533	56.7919	1.0236E 04	22000
2400	2.0477	2.61266	2.61266	5.19178	52.1141	57.3059	1.1364E 04	24000
2600	2.0692	2.64926	2.64926	5.26552	52.5325	57.7971	1.2507E 04	26000
2800	2.0952	2.68827	2.68827	5.34703	52.9255	58.2675	1.3650E 04	28000
3000	2.1255	2.72832	2.72832	5.43163	53.2948	58.7104	1.4819E 04	30000
3200	2.1598	2.76979	2.76979	5.51997	53.6432	59.1502	1.5969E 04	32000
3400	2.1978	2.81308	2.81308	5.61144	53.9850	59.5632	1.7164E 04	34000
3600	2.2391	2.85840	2.85840	5.70619	54.3200	59.9577	1.8355E 04	36000
3800	2.2833	2.90577	2.90577	5.80434	54.6484	60.3340	1.9550E 04	38000
4000	2.3300	2.95420	2.95420	5.90605	54.9705	60.6927	2.0753E 04	40000
4200	2.3789	3.00360	3.00360	6.01142	55.2862	61.0343	2.1933E 04	42000
4400	2.4295	3.05396	3.05396	6.12043	55.5953	61.3594	2.3118E 04	44000
4600	2.4817	3.10529	3.10529	6.23307	55.8978	61.6680	2.4307E 04	46000
4800	2.5351	3.15760	3.15760	6.34933	56.1938	61.9603	2.5497E 04	48000
5000	2.5894	3.21090	3.21090	6.46920	56.4833	62.2465	2.6687E 04	50000
5200	2.6448	3.26518	3.26518	6.59267	56.7664	62.5268	2.7877E 04	52000
5400	2.7010	3.32045	3.32045	6.71974	57.0431	62.8012	2.9067E 04	54000
5600	2.7579	3.37670	3.37670	6.85040	57.3134	63.0697	3.0257E 04	56000
5800	2.8154	3.43393	3.43393	6.98465	57.5773	63.3323	3.1447E 04	58000
6000	2.8735	3.49214	3.49214	7.12249	57.8348	63.5890	3.2637E 04	60000
6200	2.9321	3.55033	3.55033	7.26472	58.0859	63.8398	3.3827E 04	62000
6400	2.9912	3.60850	3.60850	7.41154	58.3306	64.0846	3.5017E 04	64000
6600	3.0507	3.66664	3.66664	7.56295	58.5689	64.3233	3.6207E 04	66000
6800	3.1106	3.72475	3.72475	7.71896	58.8008	64.5560	3.7397E 04	68000
7000	3.1709	3.78283	3.78283	7.87957	59.0263	64.7827	3.8587E 04	70000
7200	3.2316	3.84088	3.84088	8.04478	59.2454	64.9934	3.9777E 04	72000
7400	3.2927	3.89890	3.89890	8.21459	59.4581	65.1981	4.0967E 04	74000
7600	3.3542	3.95689	3.95689	8.38899	59.6644	65.3968	4.2157E 04	76000
7800	3.4161	4.01485	4.01485	8.56799	59.8644	65.5895	4.3347E 04	78000
8000	3.4784	4.07278	4.07278	8.75159	60.0581	65.7762	4.4537E 04	80000
8200	3.5411	4.13069	4.13069	8.93979	60.2454	65.9569	4.5727E 04	82000
8400	3.6042	4.18857	4.18857	9.13259	60.4273	66.1316	4.6917E 04	84000
8600	3.6677	4.24642	4.24642	9.33000	60.6038	66.2993	4.8107E 04	86000
8800	3.7316	4.30424	4.30424	9.53200	60.7749	66.4610	4.9297E 04	88000
9000	3.7959	4.36203	4.36203	9.73859	60.9406	66.6167	5.0487E 04	90000
9200	3.8606	4.41979	4.41979	9.94979	61.1009	66.7664	5.1677E 04	92000
9400	3.9257	4.47752	4.47752	10.16559	61.2558	66.9101	5.2867E 04	94000
9600	3.9912	4.53522	4.53522	10.38599	61.4054	67.0478	5.4057E 04	96000
9800	4.0571	4.59289	4.59289	10.61099	61.5497	67.1805	5.5247E 04	98000
10000	4.1234	4.65052	4.65052	10.84059	61.6888	67.3082	5.6437E 04	100000

TABLE 71. IDEAL GAS FUNCTIONS FOR 0  $\pm$  ATOMIC WEIGHT 15.9972, R = 1.98717 CAL/MOLE  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N  $\pm$ . SEE TABLE 65 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNC.	$\ln \frac{q}{N}$	$\ln \frac{q}{N} - \frac{E^0}{RT}$	$\frac{E^0}{RT}$	$\frac{E^0}{RT} - \frac{E^0}{RT}$	$\frac{E^0}{RT} - \frac{E^0}{RT}$	$\frac{E^0}{RT} - \frac{E^0}{RT}$	$\frac{E^0}{RT} - \frac{E^0}{RT}$	$\frac{E^0}{RT} - \frac{E^0}{RT}$	TEMP. (°K)
5000	1.0000	2.50000	21.7866	24.2666	4.96791	43.2937	48.2616	1.4904E 04	2.4840E 04	2.1647E 05
5200	1.0000	2.50000	21.8867	24.3467	4.96791	43.4885	48.4564	1.5000E 04	2.4883E 04	2.2614E 05
5400	1.0000	2.50000	21.9791	24.4791	4.96791	43.6760	48.6439	1.5096E 04	2.4927E 04	2.3595E 05
5600	1.0000	2.50000	22.0700	24.5700	4.96791	43.8567	48.8246	1.5182E 04	2.4969E 04	2.4540E 05
5800	1.0000	2.50000	22.1577	24.6577	4.96791	44.0310	48.9989	1.5268E 04	2.5010E 04	2.5450E 05
6000	1.0000	2.50000	22.2425	24.7425	4.96791	44.1994	49.1673	1.5354E 04	2.5050E 04	2.6320E 05
6200	1.0000	2.50000	22.3244	24.8244	4.96791	44.3623	49.3302	1.5440E 04	2.5089E 04	2.7150E 05
6400	1.0000	2.50000	22.4038	24.9038	4.96791	44.5201	49.4880	1.5526E 04	2.5127E 04	2.7950E 05
6600	1.0000	2.50000	22.4807	24.9807	4.96791	44.6729	49.6408	1.5612E 04	2.5165E 04	2.8720E 05
6800	1.0000	2.50000	22.5554	25.0554	4.96791	44.8212	49.7892	1.5698E 04	2.5203E 04	2.9470E 05
7000	1.0000	2.50001	22.6278	25.1278	4.96791	44.9652	49.9332	1.5784E 04	2.5241E 04	3.0200E 05
7200	1.0000	2.50001	22.6983	25.1983	4.96791	45.1052	50.0731	1.5870E 04	2.5279E 04	3.0910E 05
7400	1.0000	2.50002	22.7668	25.2668	4.96791	45.2413	50.2092	1.5956E 04	2.5317E 04	3.1600E 05
7600	1.0000	2.50002	22.8334	25.3334	4.96791	45.3738	50.3418	1.6042E 04	2.5355E 04	3.2280E 05
7800	1.0000	2.50003	22.8984	25.3984	4.96791	45.5028	50.4708	1.6128E 04	2.5393E 04	3.2940E 05
8000	1.0000	2.50005	22.9617	25.4617	4.96801	45.6286	50.5966	1.6214E 04	2.5431E 04	3.3590E 05
8200	1.0000	2.50007	23.0234	25.5235	4.96801	45.7513	50.7193	1.6300E 04	2.5469E 04	3.4230E 05
8400	1.0000	2.50009	23.0836	25.5837	4.96810	45.8710	50.8391	1.6386E 04	2.5507E 04	3.4860E 05
8600	1.0000	2.50011	23.1425	25.6426	4.96817	45.9879	50.9564	1.6472E 04	2.5545E 04	3.5480E 05
8800	1.0000	2.50017	23.1995	25.7001	4.96825	46.1021	51.0704	1.6558E 04	2.5583E 04	3.6100E 05
9000	1.0000	2.50022	23.2551	25.7564	4.96836	46.2133	51.1821	1.6644E 04	2.5621E 04	3.6710E 05
9200	1.0000	2.50029	23.3111	25.8114	4.96850	46.3230	51.2915	1.6730E 04	2.5659E 04	3.7320E 05
9400	1.0000	2.50036	23.3649	25.8652	4.96866	46.4298	51.3985	1.6816E 04	2.5697E 04	3.7920E 05
9600	1.0000	2.50048	23.4175	25.9180	4.96887	46.5344	51.5033	1.6902E 04	2.5735E 04	3.8520E 05
9800	1.0001	2.50061	23.4691	25.9697	4.96912	46.6365	51.6060	1.6988E 04	2.5773E 04	3.9120E 05
10000	1.0001	2.50076	23.5196	26.0203	4.96942	46.7373	51.7067	1.7074E 04	2.5811E 04	3.9720E 05
10500	1.0001	2.50127	23.6416	26.1429	4.97043	46.9798	51.9502	1.7242E 04	2.5910E 04	4.0920E 05
11000	1.0002	2.50202	23.7580	26.2600	4.97193	47.2110	52.1830	1.7410E 04	2.6009E 04	4.2120E 05
11500	1.0003	2.50309	23.8692	26.3723	4.97405	47.4321	52.4067	1.7578E 04	2.6108E 04	4.3320E 05
12000	1.0005	2.50454	23.9758	26.4803	4.97694	47.6438	52.6208	1.7746E 04	2.6207E 04	4.4520E 05
12500	1.0007	2.50648	24.0781	26.5845	4.98078	47.8471	52.8279	1.7914E 04	2.6306E 04	4.5720E 05
13000	1.0010	2.50897	24.1764	26.6854	4.98573	48.0425	53.0283	1.8082E 04	2.6405E 04	4.6920E 05
13500	1.0014	2.51210	24.2712	26.7833	4.99196	48.2308	53.2228	1.8250E 04	2.6504E 04	4.8120E 05
14000	1.0019	2.51596	24.3626	26.8785	4.99963	48.4125	53.4131	1.8418E 04	2.6603E 04	4.9320E 05
14500	1.0025	2.52063	24.4510	26.9716	5.00890	48.5881	53.5970	1.8586E 04	2.6702E 04	5.0520E 05
15000	1.0033	2.52617	24.5365	27.0627	5.01992	48.7591	53.7780	1.8754E 04	2.6801E 04	5.1720E 05
15500	1.0043	2.53285	24.6194	27.1521	5.03280	48.9229	53.9557	1.8922E 04	2.6900E 04	5.2920E 05
16000	1.0054	2.54014	24.7000	27.2401	5.04767	49.0826	54.1306	1.9090E 04	2.7000E 04	5.4120E 05
16500	1.0068	2.54866	24.7782	27.3269	5.06461	49.2391	54.3031	1.9258E 04	2.7100E 04	5.5320E 05
17000	1.0084	2.55826	24.8545	27.4127	5.08369	49.3899	54.4736	1.9426E 04	2.7200E 04	5.6520E 05
17500	1.0103	2.56897	24.9288	27.4977	5.10496	49.5376	54.6426	1.9594E 04	2.7300E 04	5.7720E 05
18000	1.0124	2.58079	25.0013	27.5811	5.12845	49.6817	54.8102	1.9762E 04	2.7400E 04	5.8920E 05
18500	1.0148	2.59373	25.0722	27.6633	5.15416	49.8226	54.9768	1.9930E 04	2.7500E 04	6.0120E 05
19000	1.0176	2.60777	25.1416	27.7493	5.18207	49.9604	55.1425	2.0098E 04	2.7600E 04	6.1320E 05
19500	1.0206	2.62291	25.2095	27.8324	5.21215	50.0954	55.3076	2.0266E 04	2.7700E 04	6.2520E 05



TABLE 21 (CONT.). IDEAL GAS FUNCTIONS FOR D 4+

TEMP. (°K)	PARTIT. FUNCT.	$\frac{U^0 - U}{RT}$	$-\frac{U^0 - U}{RT}$	$\ln \frac{U^0 - U}{RT}$	$-\ln \frac{U^0 - U}{RT}$	$\ln \frac{U^0 - U}{RT} - \ln \frac{U^0 - U}{RT}$	$-\ln \frac{U^0 - U}{RT}$	$\ln \frac{U^0 - U}{RT} - \ln \frac{U^0 - U}{RT}$	TEMP. (°K)			
20000	1.0240	2.63910	25.2761	27.9152	5.24433	50.2278	55.4721	6.51436	04	1.00446	04	20000
22000	1.0412	2.71364	25.5310	28.2446	5.39244	50.7343	56.1268	7.49166	04	1.16436	05	22000
24000	1.0646	2.80096	25.7708	28.5718	5.56598	51.2108	56.7768	8.58926	04	1.33506	05	24000
26000	1.0946	2.89660	25.9987	28.8953	5.75603	51.6438	57.4198	9.79906	04	1.49646	05	26000
28000	1.1314	2.99589	26.2170	29.2129	5.95933	52.0975	58.0509	1.11036	05	1.64646	05	28000
30000	1.1747	3.09465	26.4271	29.5217	6.14959	52.5150	58.6646	1.24876	05	1.84496	05	30000
32000	1.2244	3.18958	26.6299	29.8194	6.33822	52.9179	59.2562	1.39236	05	2.02826	05	32000
34000	1.2801	3.27832	26.8259	30.1043	6.51557	53.3076	59.8221	1.53936	05	2.21506	05	34000
36000	1.3415	3.35947	27.0157	30.3751	6.67562	53.6846	60.3684	1.68796	05	2.40336	05	36000
38000	1.4081	3.43235	27.1993	30.6316	6.82066	54.0495	60.8701	1.83476	05	2.59186	05	38000
40000	1.4794	3.49688	27.3770	30.8739	6.94888	54.4026	61.3515	1.98476	05	2.77946	05	40000
42000	1.5555	3.55334	27.5490	31.1024	7.06108	54.7445	61.8085	2.13106	05	2.96576	05	42000
44000	1.6355	3.60237	27.7155	31.3177	7.15830	55.0752	62.2395	2.27536	05	3.14976	05	44000
46000	1.7193	3.64432	27.8764	31.5209	7.24186	55.3953	62.6372	2.41726	05	3.33136	05	46000
48000	1.8065	3.68019	28.0324	31.7126	7.31314	55.7051	63.0102	2.55636	05	3.51036	05	48000
50000	1.8968	3.71037	28.1833	31.8939	7.37352	56.0049	63.3784	2.69326	05	3.68606	05	50000
60000	2.3875	3.80114	28.8691	32.6703	7.59349	57.3678	64.9213	3.33906	05	4.53216	05	60000
70000	2.9254	3.82868	29.4577	33.2664	7.60822	58.5374	66.1496	3.93476	05	5.32586	05	70000
80000	3.4934	3.82554	29.9690	33.7945	7.60198	59.5533	67.1593	4.49196	05	6.08166	05	80000
90000	4.0801	3.80922	30.4187	34.2719	7.56955	60.4470	68.0165	5.02416	05	6.81266	05	90000
100000	4.6790	3.79041	30.8191	34.6095	7.53217	61.2426	68.7747	5.54506	05	7.53226	05	100000
150000	7.8764	3.62921	32.3535	36.1827	8.0927	64.2918	71.9011	6.43326	06	9.44386	06	150000
200000	11.9444	4.09168	33.4891	37.5850	8.13919	66.5484	74.6876	1.23046	06	1.33106	07	200000
300000	24.7781	4.53381	35.2325	39.6645	8.81072	70.0127	78.8235	2.04716	06	2.10046	07	300000
400000	42.9708	4.35054	36.5022	40.8128	8.64524	72.5560	81.1812	2.66326	06	2.90146	07	400000
500000	63.6204	4.15519	37.4525	41.6077	8.25705	74.4243	82.6814	3.13496	06	3.72126	07	500000
600000	84.5643	3.86432	38.1928	42.1876	7.87856	75.8954	83.7741	3.53406	06	4.55376	07	600000
800000	123.4091	3.46729	39.2961	42.8576	7.28732	78.0789	85.3434	4.24036	06	5.43006	07	800000
1000000	156.4224	3.46202	40.0850	43.3470	6.87960	79.6575	86.5351	4.89246	06	6.07966	07	1000000
1500000	218.7576	3.16290	41.4249	44.5878	6.28520	82.3181	88.6083	6.44706	06	9.42706	07	1500000
2000000	256.1329	3.00422	42.3110	45.3152	5.96988	84.0790	90.0488	7.96546	06	1.19406	07	2000000
3000000	303.3408	2.84043	43.4938	46.3343	5.64440	86.4294	92.0738	1.09726	07	1.69336	08	3000000
4000000	330.3706	2.75682	44.2984	47.0552	5.47825	88.0282	93.5045	1.39646	07	2.19136	08	4000000
5000000	347.8131	2.70614	44.9077	47.6136	5.37756	89.2390	94.6166	1.69526	07	2.68806	08	5000000
6000000	359.9843	2.67216	45.3979	48.0701	5.31003	90.2131	95.5232	1.99376	07	3.18606	08	6000000
8000000	375.8382	2.62947	46.1602	48.7897	5.22518	91.7280	96.9931	2.59046	07	4.18016	08	8000000
10000000	385.7048	2.60373	46.7440	49.3477	5.17405	92.6880	98.0621	3.18696	07	5.17416	08	10000000

TABLE 22. IDEAL GAS FUNCTIONS FOR AR 4+ (ATOMIC WEIGHT 39.9484,  $R = 1.90717$  CAL/MOLE) BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $N \leq 6$ . SEE TABLE 44 FOR LIST OF STATES USED.

TEMP. (°F)	TEMP. (°C)	PARTIT. FUNCT.	$\frac{H^2-E}{RT}$	$\frac{H^2-E}{RT}$	$57M$	$(H^2-E)VT - \frac{(H^2-E)^2}{CAL/MOLE}$	$S^2$	$S^2-E^2$	$-\frac{H^2-E}{CAL/MOLE}$	$-(S^2-E^2)$	TEMP. (°F)	
6.2394	2.88058	24.9902	27.9708	5.72420	49.6997	55.3899	1.86836	04	2.84218	04	2.48306	05
6.3324	2.87337	25.1030	27.9764	5.70985	49.8839	55.5938	1.93586	04	2.84918	04	2.59406	05
6.4214	2.86699	25.2114	28.0764	5.69719	50.0992	55.7963	2.00346	04	3.07826	04	2.70546	05
6.5071	2.86137	25.3155	28.0769	5.68602	50.3061	55.9922	2.07146	04	3.18426	04	2.81716	05
6.5895	2.85642	25.4156	28.2723	5.67617	50.5065	56.1817	2.13946	04	3.29226	04	2.92796	05
6.6691	2.85205	25.5126	28.3647	5.66752	50.6973	56.3653	2.20826	04	3.40096	04	3.04196	05
6.7441	2.84821	25.6061	28.4543	5.65986	50.8835	56.5423	2.27716	04	3.50916	04	3.15496	05
6.8207	2.84482	25.6964	28.5413	5.65313	51.0631	56.7162	2.34626	04	3.61806	04	3.26806	05
6.8932	2.84188	25.7839	28.6258	5.64720	51.2369	56.8841	2.41546	04	3.72726	04	3.38106	05
6.9636	2.83921	25.8687	28.7079	5.64198	51.4054	57.0474	2.48516	04	3.83646	04	3.49546	05
7.0322	2.83689	25.9510	28.7879	5.63737	51.5689	57.2043	2.55516	04	3.94646	04	3.60986	05
7.0990	2.83486	26.0309	28.8657	5.63330	51.7277	57.3610	2.62526	04	4.05606	04	3.72446	05
7.1643	2.83303	26.1085	28.9416	5.62969	51.8820	57.5117	2.69596	04	4.16606	04	3.83986	05
7.2280	2.83142	26.1841	29.0155	5.62649	52.0321	57.6586	2.76596	04	4.27616	04	3.95446	05
7.2904	2.82998	26.2576	29.0876	5.62365	52.1782	57.8018	2.83636	04	4.38646	04	4.06996	05
7.3514	2.82870	26.3292	29.1579	5.62110	52.3205	57.9416	2.90726	04	4.49696	04	4.18546	05
7.4112	2.82755	26.3991	29.2266	5.61882	52.4593	58.0781	2.97806	04	4.60746	04	4.30176	05
7.4699	2.82652	26.4672	29.2937	5.61676	52.5947	58.2114	3.04896	04	4.71816	04	4.41806	05
7.5274	2.82558	26.5337	29.3593	5.61489	52.7268	58.3417	3.11996	04	4.82886	04	4.53446	05
7.5839	2.82471	26.5986	29.4233	5.61318	52.8559	58.4640	3.19096	04	4.93946	04	4.65136	05
7.6393	2.82382	26.6621	29.4860	5.61160	52.9820	58.5936	3.26206	04	5.05046	04	4.76846	05
7.6939	2.82319	26.7242	29.5473	5.61014	53.1053	58.7155	3.33316	04	5.16136	04	4.88576	05
7.7475	2.82250	26.7849	29.6074	5.60877	53.2260	58.8347	3.40436	04	5.27226	04	5.00326	05
7.8002	2.82184	26.8443	29.6661	5.60747	53.3440	58.9515	3.47536	04	5.38326	04	5.12106	05
7.8521	2.82122	26.9025	29.7231	5.60624	53.4596	59.0659	3.54636	04	5.49416	04	5.23906	05
7.9031	2.82063	26.9594	29.7801	5.60505	53.5729	59.1779	3.61736	04	5.60516	04	5.35786	05
7.9575	2.81921	27.0170	29.8362	5.60223	53.6843	59.4405	3.79586	04	5.88236	04	5.63936	05
8.0143	2.81784	27.1282	30.0460	5.59679	54.1048	59.7043	3.97546	04	6.15956	04	5.95186	05
8.0630	2.81647	27.2354	30.1698	5.59050	54.3557	59.9525	4.15116	04	6.43936	04	6.25096	05
8.1748	2.81508	27.4732	30.2883	5.59402	54.5938	60.1878	4.32826	04	6.71206	04	6.55136	05
8.4930	2.81344	27.5881	30.5017	5.59821	54.8221	60.4133	4.50506	04	6.98906	04	6.85286	05
8.5877	2.81215	27.6984	30.5106	5.59881	55.0414	60.6296	4.68146	04	7.26476	04	7.15546	05
8.6842	2.81085	27.8045	30.6151	5.59520	55.2522	60.8374	4.85736	04	7.54006	04	7.45906	05
8.7872	2.80902	27.9067	30.7157	5.59200	55.4553	61.0373	5.03206	04	7.81406	04	7.76376	05
8.8832	2.80739	28.0053	30.8127	5.57875	55.6511	61.2290	5.20706	04	8.08926	04	8.06946	05
8.9760	2.80572	28.1004	30.9061	5.57544	55.8402	61.4156	5.38246	04	8.36326	04	8.37606	05
9.0682	2.80403	28.1924	31.0004	5.57208	56.0229	61.5950	5.55846	04	8.63676	04	8.64346	05
9.1559	2.80233	28.2814	31.0937	5.56869	56.1988	61.7685	5.73046	04	8.90906	04	8.90206	05
9.2392	2.80064	28.3676	31.1862	5.56530	56.3711	61.9384	5.90306	04	9.18276	04	9.18126	05
9.3223	2.80893	28.4512	31.2501	5.56193	56.5372	62.0999	6.07716	04	9.45536	04	9.45136	05
9.4032	2.79726	28.5323	31.3295	5.55864	56.6984	62.2570	6.25006	04	9.72746	04	9.72326	05
9.4820	2.79562	28.6111	31.4067	5.55537	56.8549	62.4103	6.42286	04	9.99976	04	1.02346	06
9.5590	2.79404	28.6876	31.4817	5.55222	57.0071	62.5593	6.59536	04	1.02726	05	1.02346	06
9.6340	2.79252	28.7621	31.5546	5.54919	57.1561	62.7045	6.76706	04	1.05496	05	1.06596	06
9.7073	2.79106	28.8346	31.6257	5.54631	57.2992	62.8495	6.94036	04	1.08196	05	1.11736	06

TABLE 22 (CONT.). IDEAL GAS FUNCTIONS FOR AR 4+

TEMP. (°K)	PARTIT. FUNC.	$\frac{h^2}{2\pi m k T}$	$-\frac{h^2}{2\pi m k T}$	$\ln \frac{h^2}{2\pi m k T}$	$\ln \frac{h^2}{2\pi m k T} - \frac{5}{2}$	$-\ln \frac{h^2}{2\pi m k T} - \frac{5}{2}$	$-\ln \frac{h^2}{2\pi m k T} - \frac{5}{2} - \frac{1}{2} \ln \frac{h^2}{2\pi m k T}$	$-\ln \frac{h^2}{2\pi m k T} - \frac{5}{2} - \frac{1}{2} \ln \frac{h^2}{2\pi m k T}$	TEMP. (°K)	
2000	9.7789	2.78970	28.9053	31.0990	5.54359	57.4305	62.9832	7.1120E 04	1.1400E 06	20000
2200	10.0505	2.78524	29.1709	31.0954	5.53674	57.9675	63.5822	7.0847E 04	1.2176E 05	22000
2400	10.3018	2.78282	29.4132	32.1960	5.52993	58.4480	63.9748	8.5024E 04	1.3772E 05	24000
2600	10.5375	2.78284	29.6359	32.4187	5.52496	58.8914	64.4216	9.2113E 04	1.5370E 05	26000
2800	10.7616	2.78556	29.8422	32.6278	5.53537	59.3614	64.8368	9.9350E 04	1.6004E 06	28000
3000	10.9776	2.79116	30.0346	32.8237	5.54649	59.8037	65.2382	1.0637E 05	1.7905E 06	30000
3200	11.1887	2.79971	30.2150	33.0167	5.55849	60.2421	65.6056	1.1444E 05	1.8994E 05	32000
3400	11.3976	2.81128	30.3850	33.1965	5.56948	60.7002	65.9664	1.2230E 05	1.8994E 05	34000
3600	11.6069	2.82589	30.5461	33.3720	5.58150	61.1807	66.3157	1.3042E 05	2.0210E 05	36000
3800	11.8186	2.84354	30.6994	33.5429	5.59509	61.6847	66.6553	1.3921E 05	2.1472E 05	38000
4000	12.0349	2.86427	30.8457	33.7100	5.60918	62.2156	67.0874	1.4812E 05	2.2707E 05	40000
4200	12.2576	2.88808	30.9840	33.8741	5.62390	62.7744	67.5135	1.5750E 05	2.4104E 05	42000
4400	12.4805	2.91497	31.1210	34.0360	5.63922	63.3526	67.9351	1.6744E 05	2.5647E 05	44000
4600	12.7233	2.94496	31.2512	34.1962	5.65520	63.9539	68.3526	1.7790E 05	2.6920E 05	46000
4800	12.9816	2.97798	31.3773	34.3552	5.67175	64.6154	68.7695	1.8867E 05	2.8409E 05	48000
5000	13.2469	3.01405	31.4995	34.5136	5.68942	65.4178	69.1842	2.0011E 05	2.9947E 05	50000
6000	14.8223	3.23631	32.0677	35.3040	6.43109	63.7239	70.1550	2.6444E 05	3.8587E 05	60000
7000	16.9513	3.51031	32.5867	36.0970	6.97556	64.7552	71.7308	3.4919E 05	4.8829E 05	70000
8000	19.7594	3.80020	33.0744	36.8748	7.55163	65.7243	73.7600	4.4514E 05	5.2379E 06	80000
9000	23.3984	4.06969	33.5379	37.6076	8.08715	66.6454	74.7326	5.4900E 05	5.9981E 06	90000
10000	27.9424	4.29458	33.9788	38.2736	8.53405	67.5215	76.0555	6.5449E 05	6.7522E 06	100000
15000	64.7184	4.71032	35.8324	40.5427	9.36018	71.2049	80.5650	1.1040E 06	1.5040E 06	150000
20000	120.5037	4.56827	37.1732	41.7415	9.07790	73.4893	82.9472	1.4181E 06	1.8158E 06	200000
30000	255.7537	4.12508	38.9394	43.0645	8.19722	77.3791	85.5763	1.8430E 06	2.4592E 06	300000
40000	389.2408	3.79959	40.0786	43.8782	7.55042	79.6428	87.1932	2.2235E 06	3.0202E 06	400000
50000	507.0526	3.57526	40.9089	44.4761	7.10463	81.2788	88.3814	2.5587E 06	3.5523E 06	500000
60000	607.7148	3.41471	41.5378	44.9525	6.78560	82.5424	89.3280	2.8791E 06	4.0714E 06	600000
80000	765.9948	3.20262	42.4184	45.6910	6.34413	84.4315	90.7957	3.5014E 06	5.0913E 06	800000
100000	882.4050	3.06967	43.1878	46.2574	6.09993	85.8212	91.9212	4.1178E 06	5.9999E 06	1000000
150000	1068.6634	2.88622	44.3929	47.2792	5.73539	88.2161	93.9515	5.6223E 06	8.6031E 06	1500000
200000	1177.4513	2.79199	45.2091	48.0011	5.54814	89.8379	95.3861	7.1219E 06	1.1094E 07	2000000
300000	1298.3037	2.69617	46.3205	49.0186	5.35773	92.0484	97.4041	1.0112E 07	1.5073E 07	3000000
400000	1363.6903	2.64768	47.0888	49.7365	5.26138	93.5732	98.5346	1.3097E 07	2.1044E 07	4000000
500000	1404.6153	2.61841	47.6762	50.2946	5.20321	94.7405	99.9438	1.6080E 07	2.6016E 07	5000000
600000	1432.6309	2.59882	48.1518	50.7506	5.16428	95.6855	100.8498	1.9063E 07	3.0984E 07	6000000
800000	1466.4973	2.57425	48.8957	51.4700	5.11546	97.1639	102.2793	2.5024E 07	4.0924E 07	8000000
1000000	1490.4790	2.55946	49.4684	52.0279	5.08608	98.3019	103.3880	3.0969E 07	5.0861E 07	10000000

TABLE 23. IDEAL GAS FUNCTIONS FOR C<sub>5</sub> (ATOMIC WEIGHT 12.0064, R = 1.9871 CAL/MOLE) BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 67 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNC.	$\frac{U^0-E^0}{RT}$	$-\frac{F^0-E^0}{RT}$	$\frac{S^0}{R}$	$\ln \frac{U^0-E^0}{RT} - \frac{F^0-E^0}{RT} - \frac{S^0}{R}$	$\ln \frac{U^0-E^0}{RT} - \frac{F^0-E^0}{RT} - \frac{S^0}{R} - \frac{1}{2} \ln \frac{M}{2\pi}$	$\ln \frac{U^0-E^0}{RT} - \frac{F^0-E^0}{RT} - \frac{S^0}{R} - \frac{1}{2} \ln \frac{M}{2\pi} - \frac{1}{2} \ln \frac{h^3}{k^3 T^3}$	$\ln \frac{U^0-E^0}{RT} - \frac{F^0-E^0}{RT} - \frac{S^0}{R} - \frac{1}{2} \ln \frac{M}{2\pi} - \frac{1}{2} \ln \frac{h^3}{k^3 T^3} - \frac{1}{2} \ln \frac{h^3}{k^3 T^3}$	TEMP. (°K)
5000	2.00000	2.50000	22.0496	24.5496	4.96791	44.7891	48.7891	1.99046	5000
5200	2.00000	2.50000	22.1476	24.6476	4.96791	44.8110	48.8110	1.99046	5200
5400	2.00000	2.50000	22.2420	24.7420	4.96791	44.8329	48.8329	1.99046	5400
5600	2.00000	2.50000	22.3329	24.8329	4.96791	44.8548	48.8548	1.99046	5600
5800	2.00000	2.50000	22.4206	24.9206	4.96791	44.8767	48.8767	1.99046	5800
6000	2.00000	2.50000	22.5054	25.0054	4.96791	44.8986	48.8986	1.99046	6000
6200	2.00000	2.50000	22.5874	25.0874	4.96791	44.9205	48.9205	1.99046	6200
6400	2.00000	2.50000	22.6667	25.1667	4.96791	44.9424	48.9424	1.99046	6400
6600	2.00000	2.50000	22.7437	25.2437	4.96791	44.9643	48.9643	1.99046	6600
6800	2.00000	2.50000	22.8183	25.3183	4.96791	44.9862	48.9862	1.99046	6800
7000	2.00000	2.50000	22.8908	25.3908	4.96791	45.0081	49.0081	1.99046	7000
7200	2.00000	2.50000	22.9612	25.4612	4.96791	45.0299	49.0299	1.99046	7200
7400	2.00000	2.50000	23.0297	25.5297	4.96791	45.0518	49.0518	1.99046	7400
7600	2.00000	2.50000	23.0964	25.5964	4.96791	45.0737	49.0737	1.99046	7600
7800	2.00000	2.50000	23.1613	25.6613	4.96791	45.0956	49.0956	1.99046	7800
8000	2.00000	2.50000	23.2246	25.7246	4.96791	45.1175	49.1175	1.99046	8000
8200	2.00000	2.50000	23.2863	25.7863	4.96791	45.1394	49.1394	1.99046	8200
8400	2.00000	2.50000	23.3466	25.8466	4.96791	45.1613	49.1613	1.99046	8400
8600	2.00000	2.50000	23.4054	25.9054	4.96791	45.1832	49.1832	1.99046	8600
8800	2.00000	2.50000	23.4629	25.9629	4.96791	45.2051	49.2051	1.99046	8800
9000	2.00000	2.50000	23.5191	26.0191	4.96791	45.2270	49.2270	1.99046	9000
9200	2.00000	2.50000	23.5740	26.0740	4.96791	45.2489	49.2489	1.99046	9200
9400	2.00000	2.50000	23.6278	26.1278	4.96791	45.2708	49.2708	1.99046	9400
9600	2.00000	2.50000	23.6804	26.1804	4.96791	45.2927	49.2927	1.99046	9600
9800	2.00000	2.50000	23.7319	26.2319	4.96791	45.3146	49.3146	1.99046	9800
10000	2.00000	2.50000	23.7825	26.2825	4.96791	45.3365	49.3365	1.99046	10000
10500	2.00000	2.50000	23.9044	26.4044	4.96791	45.3984	49.3984	1.99046	10500
11000	2.00000	2.50000	24.0207	26.5207	4.96791	45.4603	49.4603	1.99046	11000
11500	2.00000	2.50000	24.1319	26.6319	4.96791	45.5222	49.5222	1.99046	11500
12000	2.00000	2.50000	24.2383	26.7383	4.96791	45.5841	49.5841	1.99046	12000
12500	2.00000	2.50000	24.3403	26.8403	4.96791	45.6460	49.6460	1.99046	12500
13000	2.00000	2.50000	24.4384	26.9384	4.96791	45.7079	49.7079	1.99046	13000
13500	2.00000	2.50000	24.5327	27.0327	4.96791	45.7698	49.7698	1.99046	13500
14000	2.00000	2.50000	24.6236	27.1236	4.96791	45.8317	49.8317	1.99046	14000
14500	2.00000	2.50000	24.7114	27.2114	4.96791	45.8936	49.8936	1.99046	14500
15000	2.00000	2.50000	24.7961	27.2961	4.96791	45.9555	49.9555	1.99046	15000
15500	2.00000	2.50000	24.8781	27.3781	4.96791	46.0174	50.0174	1.99046	15500
16000	2.00000	2.50000	24.9575	27.4575	4.96791	46.0793	50.0793	1.99046	16000
16500	2.00000	2.50000	25.0344	27.5344	4.96791	46.1412	50.1412	1.99046	16500
17000	2.00000	2.50000	25.1090	27.6090	4.96791	46.2031	50.2031	1.99046	17000
17500	2.00000	2.50000	25.1815	27.6815	4.96791	46.2650	50.2650	1.99046	17500
18000	2.00000	2.50000	25.2519	27.7519	4.96791	46.3269	50.3269	1.99046	18000
18500	2.00000	2.50000	25.3204	27.8204	4.96791	46.3888	50.3888	1.99046	18500
19000	2.00000	2.50000	25.3871	27.8871	4.96791	46.4507	50.4507	1.99046	19000
19500	2.00000	2.50000	25.4520	27.9520	4.96791	46.5126	50.5126	1.99046	19500

TABLE 23 (CONT.). IDEAL GAS FUNCTIONS FOR C 5+

TEMP. (°K)	PARTIAL PRESSURE	$\frac{h^2 - \epsilon}{RT}$	$-\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$-\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$-\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$-\frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$-\frac{h^2 - \epsilon}{RT}$	TEMP. (°K)
20000	2.0000	2.50000	25.5153	28.0153	4.96791	50.7032	55.6711	5.96156	9.93586	04	1.0141E 04	20000
22000	2.0000	2.50000	25.7536	28.2536	4.96791	51.1767	56.1446	6.5576E 04	1.0929E 05	1.1259E 04	22000	
24000	2.0000	2.50000	25.9711	28.4711	4.96791	51.6049	56.5768	7.1533E 04	1.1923E 05	1.2366E 04	24000	
26000	2.0000	2.50000	26.1712	28.6712	4.96791	52.0046	56.9745	7.7499E 04	1.2917E 05	1.3422E 04	26000	
28000	2.0000	2.50000	26.3565	28.8565	4.96791	52.3747	57.3426	8.3441E 04	1.3910E 05	1.4466E 04	28000	
30000	2.0000	2.50000	26.5290	29.0290	4.96791	52.7175	57.6054	8.9423E 04	1.4904E 05	1.5491E 04	30000	
32000	2.0000	2.50000	26.6903	29.1903	4.96791	53.0381	57.8060	9.5384E 04	1.5897E 05	1.6492E 04	32000	
34000	2.0000	2.50000	26.8419	29.3419	4.96791	53.3393	58.0072	1.0133E 05	1.6891E 05	1.7473E 04	34000	
36000	2.0000	2.50000	26.9848	29.4848	4.96791	53.6232	58.1911	1.0713E 05	1.7894E 05	1.8436E 04	36000	
38000	2.0000	2.50000	27.1200	29.6200	4.96791	53.8916	58.3597	1.1327E 05	1.8907E 05	1.9384E 04	38000	
40000	2.0000	2.50000	27.2482	29.7482	4.96791	54.1467	58.5146	1.1923E 05	1.9927E 05	2.0359E 04	40000	
42000	2.0000	2.50000	27.3702	29.8702	4.96791	54.3890	58.6570	1.2519E 05	2.0965E 05	2.1343E 04	42000	
44000	2.0000	2.50000	27.4865	29.9865	4.96791	54.6201	58.8081	1.3115E 05	2.1959E 05	2.2334E 04	44000	
46000	2.0000	2.50000	27.5976	30.0976	4.96791	54.8410	58.9489	1.3715E 05	2.2925E 05	2.3327E 04	46000	
48000	2.0000	2.50000	27.7040	30.2040	4.96791	55.0524	60.0203	1.4308E 05	2.3868E 05	2.4324E 04	48000	
50000	2.0000	2.50000	27.8060	30.3060	4.96791	55.2532	60.2231	1.4904E 05	2.4806E 05	2.5326E 04	50000	
60000	2.0000	2.50000	28.2619	30.7619	4.96791	56.1610	61.1289	1.7884E 05	2.9607E 05	3.1097E 04	60000	
70000	2.0000	2.50000	28.6472	31.1672	4.96791	56.9268	61.8967	2.0865E 05	3.4775E 05	3.7049E 04	70000	
80000	2.0000	2.50000	28.9811	31.4811	4.96791	57.5902	62.5581	2.3844E 05	3.9743E 05	4.2672E 04	80000	
90000	2.0000	2.50000	29.2755	31.7755	4.96791	58.1753	63.1437	2.6827E 05	4.4711E 05	4.8111E 04	90000	
100000	2.0000	2.50000	29.5389	32.0389	4.96791	58.6967	63.6666	2.9807E 05	4.9679E 05	5.3599E 04	100000	
150000	2.0000	2.50000	30.5526	33.0526	4.96791	60.7130	65.4809	4.7711E 05	7.4510E 05	9.1070E 04	150000	
200000	2.0000	2.50000	31.2718	33.7718	4.96791	62.1422	67.1101	5.9615E 05	9.9158E 05	1.2420E 05	200000	
300000	2.0000	2.50005	32.2856	34.7855	4.96801	64.1565	69.1245	8.9423E 05	1.4904E 06	1.8247E 05	300000	
400000	2.0001	2.50172	33.0048	35.5045	4.97132	65.5860	70.5573	1.1937E 06	1.9887E 06	2.4234E 05	400000	
500000	2.0031	2.51442	33.5640	36.0785	4.99656	66.8971	71.6939	1.5047E 06	2.4983E 06	3.1349E 05	500000	
600000	2.0149	2.55916	34.0258	36.5649	5.08547	67.6148	72.7003	1.8590E 06	3.0513E 06	4.0509E 05	600000	
800000	2.1120	2.82370	34.7920	37.6157	5.61116	69.1375	74.7487	2.8997E 06	4.4489E 06	5.5310E 05	800000	
1000000	2.3822	3.29156	35.4702	38.7618	6.54088	70.5852	77.0261	4.5537E 06	6.5409E 06	7.0485E 05	1000000	
1500000	4.0007	4.16599	37.0024	41.1684	8.27E 1	73.5298	81.8083	9.4370E 06	1.2410E 07	1.1029E 06	1500000	
2000000	6.6124	4.25275	38.2240	42.4768	8.45091	75.9575	84.4084	1.2927E 07	1.4902E 07	1.5191E 06	2000000	
3000000	12.8820	3.91838	39.8889	43.8073	7.78447	79.2669	87.0524	2.3350E 07	2.3350E 07	2.3780E 06	3000000	
4000000	18.2820	3.62155	40.9759	44.8016	7.20853	81.4219	88.4304	2.8834E 07	2.8834E 07	3.2540E 06	4000000	
5000000	22.9775	3.42599	41.7403	45.4863	6.80800	82.7847	89.7227	3.4104E 07	3.4104E 07	4.1492E 06	5000000	
6000000	26.8429	3.28297	42.3718	45.8546	6.52380	84.1994	90.7232	3.9149E 07	3.9149E 07	5.0520E 06	6000000	
8000000	32.4979	3.09836	43.2801	46.3845	6.15298	86.0207	92.1737	3.3327E 07	4.9224E 07	6.0817E 06	8000000	
10000000	36.8579	2.98092	43.9658	46.9467	5.92357	87.3672	93.2908	3.9344E 07	5.9234E 07	8.7367E 06	10000000	



TABLE 24 (CONT.). IDEAL GAS FUNCTIONS FOR  $n = 3/2$ [illegible]

TABLE 25. IDEAL GAS FUNCTIONS FOR D<sup>+</sup> IONIC WEIGHT 13.9966, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 69 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{h^2 E^2}{RT^2} - \frac{h^2 E^2}{RT^2}$	$\frac{h^2 E^2}{RT^2} - \frac{h^2 E^2}{RT^2}$	$\frac{h^2 E^2}{RT^2} - \frac{h^2 E^2}{RT^2}$	$\frac{h^2 E^2}{RT^2} - \frac{h^2 E^2}{RT^2}$	$\frac{h^2 E^2}{RT^2} - \frac{h^2 E^2}{RT^2}$	$\frac{h^2 E^2}{RT^2} - \frac{h^2 E^2}{RT^2}$	$\frac{h^2 E^2}{RT^2} - \frac{h^2 E^2}{RT^2}$	TEMP. (°K)
5000	2.0000	22.4797	24.9797	4.96791	44.6710	49.6309	1.4904E 04	2.4440E 04	5000
5200	2.0000	22.5000	25.0000	4.96791	44.6858	49.6337	1.5000E 04	2.4440E 04	5200
5400	2.0000	22.5000	25.0000	4.96791	45.0333	50.0212	1.6094E 04	2.4427E 04	5400
5600	2.0000	22.5000	25.0000	4.96791	45.2631	50.2631	1.6692E 04	2.4427E 04	5600
5800	2.0000	22.5000	25.0000	4.96791	45.4083	50.3767	1.7208E 04	2.4427E 04	5800
6000	2.0000	22.5000	25.0000	4.96791	45.5767	50.5446	1.7884E 04	2.4427E 04	6000
6200	2.0000	22.5000	25.0000	4.96791	45.7396	50.7075	1.8481E 04	2.4427E 04	6200
6400	2.0000	22.5000	25.0000	4.96791	45.8973	50.8653	1.9077E 04	2.4427E 04	6400
6600	2.0000	22.5000	25.0000	4.96791	46.0502	51.0181	1.9673E 04	2.4427E 04	6600
6800	2.0000	22.5000	25.0000	4.96791	46.1985	51.1664	2.0269E 04	2.4427E 04	6800
7000	2.0000	22.5000	25.0000	4.96791	46.3425	51.3104	2.0865E 04	2.4427E 04	7000
7200	2.0000	22.5000	25.0000	4.96791	46.4823	51.4504	2.1461E 04	2.4427E 04	7200
7400	2.0000	22.5000	25.0000	4.96791	46.6186	51.5865	2.2057E 04	2.4427E 04	7400
7600	2.0000	22.5000	25.0000	4.96791	46.7511	51.7190	2.2653E 04	2.4427E 04	7600
7800	2.0000	22.5000	25.0000	4.96792	46.8801	51.8480	2.3250E 04	2.4427E 04	7800
8000	2.0000	22.5000	25.0000	4.96792	47.0059	51.9738	2.3846E 04	2.4427E 04	8000
8200	2.0000	22.5000	25.0000	4.96792	47.1286	52.0965	2.4442E 04	2.4427E 04	8200
8400	2.0000	22.5000	25.0000	4.96792	47.2483	52.2162	2.5038E 04	2.4427E 04	8400
8600	2.0000	22.5000	25.0000	4.96792	47.3652	52.3331	2.5635E 04	2.4427E 04	8600
8800	2.0000	22.5000	25.0000	4.96793	47.4794	52.4473	2.6231E 04	2.4427E 04	8800
9000	2.0000	22.5000	25.0000	4.96793	47.5910	52.5590	2.6827E 04	2.4427E 04	9000
9200	2.0000	22.5000	25.0000	4.96794	47.7002	52.6682	2.7423E 04	2.4427E 04	9200
9400	2.0000	22.5000	25.0000	4.96795	47.8071	52.7750	2.8019E 04	2.4427E 04	9400
9600	2.0000	22.5000	25.0000	4.96796	47.9117	52.8794	2.8615E 04	2.4427E 04	9600
9800	2.0000	22.5000	25.0000	4.96797	48.0141	52.9821	2.9212E 04	2.4427E 04	9800
10000	2.0000	22.5000	25.0000	4.96799	48.1145	53.0824	2.9808E 04	2.4427E 04	10000
10500	2.0000	22.5000	25.0000	4.96805	48.3568	53.3249	3.1299E 04	2.4427E 04	10500
11000	2.0000	22.5000	25.0000	4.96815	48.5880	53.5541	3.2791E 04	2.4427E 04	11000
11500	2.0000	22.5000	25.0000	4.96831	48.8088	53.7771	3.4283E 04	2.4427E 04	11500
12000	2.0000	22.5000	25.0000	4.96855	49.0205	53.9888	3.5775E 04	2.4427E 04	12000
12500	2.0000	22.5000	25.0000	4.96888	49.2731	54.1920	3.7271E 04	2.4427E 04	12500
13000	2.0000	22.5000	25.0000	4.96934	49.4180	54.3873	3.8768E 04	2.4427E 04	13000
13500	2.0000	22.5000	25.0000	4.96996	49.6055	54.5735	4.0265E 04	2.4427E 04	13500
14000	2.0000	22.5000	25.0000	4.97077	49.7863	54.7571	4.1762E 04	2.4427E 04	14000
14500	2.0000	22.5000	25.0000	4.97179	49.9608	54.9325	4.3259E 04	2.4427E 04	14500
15000	2.0000	22.5000	25.0000	4.97308	50.1293	55.1024	4.4756E 04	2.4427E 04	15000
15500	2.0000	22.5000	25.0000	4.97466	50.2924	55.2671	4.6253E 04	2.4427E 04	15500
16000	2.0000	22.5000	25.0000	4.97656	50.4504	55.4259	4.7750E 04	2.4427E 04	16000
16500	2.0000	22.5000	25.0000	4.97878	50.6034	55.5784	4.9247E 04	2.4427E 04	16500
17000	2.0000	22.5000	25.0000	4.98149	50.7522	55.7337	5.0744E 04	2.4427E 04	17000
17500	2.0000	22.5000	25.0000	4.98457	50.8967	55.8812	5.2241E 04	2.4427E 04	17500
18000	2.0000	22.5000	25.0000	4.98810	51.0371	56.0252	5.3738E 04	2.4427E 04	18000
18500	2.0000	22.5000	25.0000	4.99212	51.1739	56.1640	5.5235E 04	2.4427E 04	18500
19000	2.0000	22.5000	25.0000	4.99664	51.3071	56.2937	5.6732E 04	2.4427E 04	19000
19500	2.0000	22.5000	25.0000	5.00166	51.4369	56.4236	5.8229E 04	2.4427E 04	19500



TABLE 25 (CONT.). IDEAL GAS FUNCTIONS FOR O<sub>2</sub>

TEMP. (°K)	PARTIT. FUNC.	$\frac{h^2}{RT}$	$\frac{h^2}{RT} - \frac{E^0}{RT}$	$\frac{h^2}{RT}$	$\ln \frac{h^2}{RT} - \ln \frac{h^2}{RT} - \ln \frac{h^2}{RT}$	$\frac{h^2}{RT}$	$\frac{h^2}{RT} - \frac{E^0}{RT}$	$\frac{h^2}{RT}$	$\frac{h^2}{RT} - \frac{E^0}{RT}$	TEMP. (°K)
2000	2.0057	2.51978	25.9483	28.4681	5.00722	51.5708	6.0401E 04	1.0014E 05	1.0313E 06	20000
2200	2.0107	2.53377	26.1891	28.7229	5.03522	52.0421	6.7053E 04	1.1077E 05	1.1449E 06	22000
2400	2.0182	2.55225	26.4103	28.9626	5.07175	52.4817	7.4030E 04	1.2172E 05	1.2596E 06	24000
2600	2.0284	2.57491	26.6155	29.1905	5.11688	52.8894	8.1373E 04	1.3304E 05	1.3751E 06	26000
2800	2.0416	2.60137	26.8073	29.4086	5.16935	53.2705	8.9101E 04	1.4474E 05	1.4916E 06	28000
3000	2.0580	2.63073	26.9877	29.6185	5.22771	53.6291	9.7216E 04	1.5683E 05	1.6089E 06	30000
3200	2.0775	2.66225	27.1505	29.8208	5.29033	53.9684	1.0570E 05	1.6929E 05	1.7270E 06	32000
3400	2.1001	2.69511	27.3209	30.0160	5.3562	54.2911	1.1453E 05	1.8209E 05	1.8459E 06	34000
3600	2.1257	2.72854	27.4759	30.2044	5.42205	54.5991	1.2366E 05	1.9519E 05	1.9656E 06	36000
3800	2.1540	2.76187	27.6243	30.3862	5.48829	54.8940	1.3304E 05	2.0856E 05	2.0860E 06	38000
4000	2.1850	2.79454	27.7658	30.5613	5.55321	55.1772	1.4264E 05	2.2213E 05	2.2071E 06	40000
4200	2.2183	2.82659	27.9039	30.7300	5.61550	55.4497	1.5241E 05	2.3587E 05	2.3289E 06	42000
4400	2.2538	2.85816	28.0381	30.8922	5.67567	55.7123	1.6229E 05	2.4973E 05	2.4513E 06	44000
4600	2.2912	2.88932	28.1637	31.0482	5.73202	55.9659	1.7226E 05	2.6367E 05	2.5744E 06	46000
4800	2.3303	2.91999	28.2870	31.1980	5.78462	56.2110	1.8228E 05	2.7766E 05	2.6981E 06	48000
5000	2.3709	2.95048	28.4063	31.3418	5.83329	56.4481	1.9231E 05	2.9166E 05	2.8224E 06	50000
6000	2.5899	3.02834	28.9505	31.9788	6.01781	57.5294	2.4184E 05	3.4107E 05	3.4518E 06	60000
7000	2.8217	3.07905	29.4216	32.5006	6.11858	58.5655	2.8920E 05	4.2830E 05	4.0926E 06	70000
8000	3.0536	3.10064	29.8344	32.9350	6.16149	59.5858	3.3395E 05	4.9292E 05	4.7429E 06	80000
9000	3.2786	3.10434	30.1999	33.3043	6.16883	60.0122	3.7635E 05	5.5519E 05	5.4011E 06	90000
10000	3.4932	3.09817	30.5267	33.6249	6.15658	60.4617	4.1694E 05	6.1566E 05	6.0642E 06	100000
15000	4.4103	3.05737	31.7735	34.8309	6.07550	61.1392	6.1325E 05	9.1132E 05	9.4709E 06	150000
20000	5.2024	3.11220	32.6580	35.7702	6.18445	64.8969	8.3946E 05	1.2349E 06	1.2879E 07	200000
30000	7.0081	3.18258	33.6647	37.3473	6.22175	67.5034	1.4204E 06	2.0185E 06	2.8231E 07	300000
40000	9.2897	3.25680	34.9706	38.5774	7.06795	69.4923	2.0323E 06	2.8272E 06	2.7797E 07	400000
50000	11.8289	3.39313	35.7701	39.3632	7.14015	71.0810	2.5765E 06	3.5701E 06	3.5541E 07	500000
60000	14.4033	3.55875	36.4228	39.9815	7.07172	72.3701	3.0508E 06	4.2431E 06	4.3427E 07	600000
80000	19.2053	3.43120	37.4297	40.8609	6.81835	74.3790	4.5477E 06	5.4547E 06	5.9503E 07	800000
100000	23.3184	3.30681	38.1816	41.4884	6.57118	75.0732	6.5840E 06	6.5712E 06	7.5873E 07	1000000
150000	30.9052	3.08777	39.4770	42.5647	6.13592	78.4473	6.2231E 06	9.2039E 06	1.1767E 08	1500000
200000	35.8988	2.95762	40.3460	43.3036	5.87728	80.1741	7.7802E 06	1.1755E 07	1.6035E 08	2000000
300000	41.9238	2.81537	41.5148	44.3301	5.59460	82.4967	1.0822E 07	1.6784E 07	2.4749E 08	3000000
400000	45.3903	2.74012	42.3134	45.0535	5.44508	84.0838	1.3832E 07	2.1780E 07	3.3634E 08	4000000
500000	47.6333	2.69376	42.9195	45.6133	5.35295	85.2882	1.6829E 07	2.6745E 07	4.2644E 08	5000000
600000	49.2011	2.66237	43.4077	46.0701	5.29057	86.2583	1.9820E 07	3.1743E 07	5.1755E 08	6000000
800000	51.2445	2.62260	44.1676	46.7902	5.21155	87.7684	2.5795E 07	4.1692E 07	7.0215E 08	8000000
1000000	52.5212	2.59867	44.7501	47.3485	5.16359	88.9258	3.1764E 07	5.1636E 07	8.8726E 08	10000000

TABLE 26. IDEAL GAS FUNCTIONS FOR AR 3+ (ATOMIC WEIGHT 39.9480,  $R = 1.98717$  CAL/MOLE) SEE TABLE 70 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\ln \frac{q}{RT}$	$\ln \frac{q}{RT} - \frac{E_0}{RT}$	$\ln \frac{q}{RT} - \frac{E_0}{RT} - \frac{E_1}{RT}$	$\ln \frac{q}{RT} - \frac{E_0}{RT} - \frac{E_1}{RT} - \frac{E_2}{RT}$	$\ln \frac{q}{RT} - \frac{E_0}{RT} - \frac{E_1}{RT} - \frac{E_2}{RT} - \frac{E_3}{RT}$	$\ln \frac{q}{RT} - \frac{E_0}{RT} - \frac{E_1}{RT} - \frac{E_2}{RT} - \frac{E_3}{RT} - \frac{E_4}{RT}$	$\ln \frac{q}{RT} - \frac{E_0}{RT} - \frac{E_1}{RT} - \frac{E_2}{RT} - \frac{E_3}{RT} - \frac{E_4}{RT} - \frac{E_5}{RT}$	TEMP. (°K)		
5000	3.9303	2.92300	24.5280	27.4510	5.80849	48.7413	54.5448	1.9107E 04	2.9042E 04	2.4371E 05	9000
5200	3.9949	2.90673	24.6424	27.5491	5.77616	48.9484	54.7446	1.9703E 04	3.0034E 04	2.5444E 05	9200
5400	4.0556	2.89167	24.7518	27.6434	5.74623	49.1859	54.9321	2.0299E 04	3.1030E 04	2.6560E 05	9400
5600	4.1127	2.87748	24.8567	27.7344	5.71843	49.3967	55.1128	2.0899E 04	3.2023E 04	2.7641E 05	9600
5800	4.1666	2.86466	24.9574	27.8221	5.69255	49.5945	55.2871	2.1491E 04	3.3017E 04	2.8768E 05	9800
6000	4.2176	2.85250	25.0543	27.9068	5.66840	49.7871	55.4555	2.2087E 04	3.4010E 04	2.9937E 05	10000
6200	4.2659	2.84113	25.1477	27.9888	5.64580	49.9726	55.6184	2.2680E 04	3.5004E 04	3.1157E 05	10200
6400	4.3115	2.83047	25.2377	28.0682	5.62462	50.1515	55.7761	2.3280E 04	3.5998E 04	3.2427E 05	10400
6600	4.3549	2.82046	25.3247	28.1451	5.60472	50.3243	55.9290	2.3874E 04	3.6991E 04	3.3744E 05	10600
6800	4.3961	2.81103	25.4087	28.2198	5.58599	50.4913	56.0773	2.4472E 04	3.7988E 04	3.5104E 05	10800
7000	4.4354	2.80215	25.4901	28.2922	5.56833	50.6530	56.2213	2.5084E 04	3.8978E 04	3.6457E 05	11000
7200	4.4728	2.79375	25.5689	28.3622	5.55165	50.8096	56.3613	2.5644E 04	3.9972E 04	3.7858E 05	11200
7400	4.5084	2.78581	25.6453	28.4311	5.53597	50.9615	56.4974	2.6240E 04	4.0983E 04	3.9309E 05	11400
7600	4.5425	2.77829	25.7195	28.4978	5.52093	51.1090	56.6299	2.6857E 04	4.1995E 04	4.0717E 05	11600
7800	4.5750	2.77116	25.7916	28.5628	5.50675	51.2522	56.7589	2.7453E 04	4.2953E 04	4.2187E 05	11800
8000	4.6061	2.76438	25.8617	28.6261	5.49328	51.3914	56.8847	2.8049E 04	4.3944E 04	4.3713E 05	12000
8200	4.6359	2.75793	25.9299	28.6878	5.48046	51.5269	57.0074	2.8644E 04	4.4940E 04	4.5285E 05	12200
8400	4.6645	2.75179	25.9962	28.7480	5.46826	51.6588	57.1271	2.9241E 04	4.5933E 04	4.6913E 05	12400
8600	4.6918	2.74593	26.0609	28.8069	5.45663	51.7874	57.2440	2.9837E 04	4.6927E 04	4.8597E 05	12600
8800	4.7181	2.74035	26.1240	28.8643	5.44552	51.9127	57.3582	3.0434E 04	4.7921E 04	5.0347E 05	12800
9000	4.7434	2.73501	26.1855	28.9205	5.43431	52.0349	57.4698	3.1030E 04	4.8914E 04	5.2163E 05	13000
9200	4.7677	2.72990	26.2456	28.9755	5.42476	52.1543	57.5790	3.1626E 04	4.9908E 04	5.4031E 05	13200
9400	4.7911	2.72501	26.3042	29.0292	5.41504	52.2708	57.6859	3.2222E 04	5.0901E 04	5.5955E 05	13400
9600	4.8136	2.72032	26.3615	29.0819	5.40573	52.3847	57.7905	3.2818E 04	5.1895E 04	5.7939E 05	13600
9800	4.8353	2.71583	26.4176	29.1334	5.39681	52.4961	57.8929	3.3414E 04	5.2888E 04	5.9984E 05	13800
10000	4.8562	2.71152	26.4724	29.1839	5.38824	52.6051	57.9933	3.4011E 04	5.3882E 04	6.2096E 05	14000
10500	4.9054	2.70146	26.6045	29.3059	5.36825	52.8075	58.2357	3.5501E 04	5.6367E 04	6.5311E 05	14500
11000	4.9505	2.69233	26.7299	29.4272	5.35011	53.1168	58.4669	3.6992E 04	5.8851E 04	6.8628E 05	15000
11500	4.9921	2.68401	26.8494	29.5334	5.33357	53.3542	58.6878	3.8484E 04	6.1336E 04	7.2047E 05	15500
12000	5.0305	2.67641	26.9635	29.6399	5.31846	53.5809	58.8993	3.9974E 04	6.3822E 04	7.5579E 05	16000
12500	5.0661	2.66944	27.0726	29.7420	5.30463	53.7977	59.1023	4.1468E 04	6.6308E 04	7.9227E 05	16500
13000	5.0993	2.66306	27.1772	29.8402	5.29194	54.0055	59.2974	4.2962E 04	6.8799E 04	8.2997E 05	17000
13500	5.1302	2.65720	27.2776	29.9348	5.28029	54.2050	59.4853	4.4457E 04	7.1284E 04	8.6881E 05	17500
14000	5.1591	2.65182	27.3741	30.0259	5.26961	54.3968	59.6665	4.5954E 04	7.3775E 04	9.0884E 05	18000
14500	5.1862	2.64690	27.4671	30.1140	5.25983	54.5816	59.8414	4.7454E 04	7.6268E 04	9.4999E 05	18500
15000	5.2117	2.64241	27.5567	30.1991	5.25090	54.7598	60.0104	4.8954E 04	7.8773E 04	9.9234E 05	19000
15500	5.2357	2.63831	27.6433	30.2816	5.24277	54.9318	60.1744	5.0454E 04	8.1283E 04	1.0359E 06	19500
16000	5.2583	2.63461	27.7270	30.3616	5.23541	55.0981	60.3335	5.1954E 04	8.3797E 04	1.0797E 06	20000
16500	5.2800	2.63126	27.8080	30.4393	5.22879	55.2591	60.4879	5.3454E 04	8.6315E 04	1.1247E 06	20500
17000	5.3005	2.62832	27.8865	30.5168	5.22291	55.4151	60.6380	5.4954E 04	8.8839E 04	1.1709E 06	21000
17500	5.3200	2.62572	27.9627	30.5948	5.21774	55.5665	60.7842	5.6454E 04	9.1368E 04	1.2184E 06	21500
18000	5.3398	2.62347	28.0366	30.6601	5.21328	55.7134	60.9267	5.7954E 04	9.3903E 04	1.2671E 06	22000
18500	5.3587	2.62158	28.1085	30.7300	5.20951	55.8562	61.0657	5.9454E 04	9.6443E 04	1.3170E 06	22500
19000	5.3760	2.62003	28.1784	30.7984	5.20644	55.9951	61.2015	6.0954E 04	9.8988E 04	1.3681E 06	23000
19500	5.3907	2.61883	28.2464	30.8652	5.20405	56.1303	61.3343	6.2454E 04	1.0148E 05	1.4204E 06	23500

TABLE 26 (CONT.). IDEAL GAS FUNCTIONS FOR  $\mu = 9.0$ [illegible]

TABLE 27. IDEAL GAS FUNCTIONS FOR C<sub>6</sub> (ATOMIC WEIGHT 12.0079, R = 1.98717 CAL/MOLE)

BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4.

TEMP. (°K)	PARTIT. FUNC.	$\frac{W^0-E^0}{RT}$	$\ln \frac{W^0-E^0}{RT}$	$\frac{W^0-E^0}{RT}$	$\ln \frac{W^0-E^0}{RT}$	$\frac{W^0-E^0}{RT}$	$\ln \frac{W^0-E^0}{RT}$	$\frac{W^0-E^0}{RT}$	$\ln \frac{W^0-E^0}{RT}$	$\frac{W^0-E^0}{RT}$	$\ln \frac{W^0-E^0}{RT}$	TEMP. (°K)
5000	1.0000	2.50000	21.3564	23.8564	4.96791	42.4388	47.4885	1.4304E 04	2.4840E 04	2.4840E 04	2.1219E 05	5000
5200	1.0000	2.50000	21.4544	23.9544	4.96791	42.6335	47.6016	1.5500E 04	2.5833E 04	2.5833E 04	2.2169E 05	5200
5400	1.0000	2.50000	21.5488	24.0488	4.96791	42.8210	47.7889	1.6694E 04	2.6827E 04	2.6827E 04	2.3123E 05	5400
5600	1.0000	2.50000	21.6397	24.1397	4.96791	43.0016	47.9696	1.7892E 04	2.7820E 04	2.7820E 04	2.4081E 05	5600
5800	1.0000	2.50000	21.7274	24.2274	4.96791	43.1760	48.1439	1.9084E 04	2.8814E 04	2.8814E 04	2.5042E 05	5800
6000	1.0000	2.50000	21.8122	24.3122	4.96791	43.3444	48.3129	2.0269E 04	2.9807E 04	2.9807E 04	2.6007E 05	6000
6200	1.0000	2.50000	21.8941	24.3941	4.96791	43.5073	48.4752	2.1451E 04	3.0801E 04	3.0801E 04	2.6975E 05	6200
6400	1.0000	2.50000	21.9735	24.4735	4.96791	43.6650	48.6329	2.2624E 04	3.1795E 04	3.1795E 04	2.7944E 05	6400
6600	1.0000	2.50000	22.0504	24.5504	4.96791	43.8179	48.7858	2.3798E 04	3.2788E 04	3.2788E 04	2.8916E 05	6600
6800	1.0000	2.50000	22.1251	24.6251	4.96791	43.9662	48.9341	2.4969E 04	3.3782E 04	3.3782E 04	2.9897E 05	6800
7000	1.0000	2.50000	22.1975	24.6975	4.96791	44.1102	49.0781	2.6136E 04	3.4775E 04	3.4775E 04	3.0877E 05	7000
7200	1.0000	2.50000	22.2680	24.7680	4.96791	44.2502	49.2181	2.7298E 04	3.5768E 04	3.5768E 04	3.1856E 05	7200
7400	1.0000	2.50000	22.3365	24.8365	4.96791	44.3863	49.3542	2.8456E 04	3.6760E 04	3.6760E 04	3.2834E 05	7400
7600	1.0000	2.50000	22.4031	24.9031	4.96791	44.5188	49.4867	2.9610E 04	3.7750E 04	3.7750E 04	3.3812E 05	7600
7800	1.0000	2.50000	22.4681	24.9681	4.96791	44.6478	49.6157	3.0760E 04	3.8739E 04	3.8739E 04	3.4789E 05	7800
8000	1.0000	2.50000	22.5314	25.0314	4.96791	44.7736	49.7415	3.1906E 04	3.9728E 04	3.9728E 04	3.5765E 05	8000
8200	1.0000	2.50000	22.5931	25.0931	4.96791	44.8962	49.8642	3.3048E 04	4.0716E 04	4.0716E 04	3.6740E 05	8200
8400	1.0000	2.50000	22.6534	25.1534	4.96791	45.0160	49.9839	3.4186E 04	4.1703E 04	4.1703E 04	3.7713E 05	8400
8600	1.0000	2.50000	22.7122	25.2122	4.96791	45.1329	50.1008	3.5320E 04	4.2689E 04	4.2689E 04	3.8684E 05	8600
8800	1.0000	2.50000	22.7697	25.2697	4.96791	45.2471	50.2150	3.6450E 04	4.3674E 04	4.3674E 04	3.9653E 05	8800
9000	1.0000	2.50000	22.8256	25.3256	4.96791	45.3587	50.3266	3.7567E 04	4.4658E 04	4.4658E 04	4.0623E 05	9000
9200	1.0000	2.50000	22.8808	25.3808	4.96791	45.4679	50.4358	3.8681E 04	4.5645E 04	4.5645E 04	4.1593E 05	9200
9400	1.0000	2.50000	22.9345	25.4345	4.96791	45.5757	50.5427	3.9791E 04	4.6631E 04	4.6631E 04	4.2562E 05	9400
9600	1.0000	2.50000	22.9872	25.4872	4.96791	45.6813	50.6472	4.0896E 04	4.7616E 04	4.7616E 04	4.3531E 05	9600
9800	1.0000	2.50000	23.0387	25.5387	4.96791	45.7818	50.7497	4.1997E 04	4.8600E 04	4.8600E 04	4.4500E 05	9800
10000	1.0000	2.50000	23.0892	25.5892	4.96791	45.8825	50.8500	4.3094E 04	4.9583E 04	4.9583E 04	4.5469E 05	10000
10500	1.0000	2.50000	23.2112	25.7112	4.96791	46.1245	51.0924	4.5198E 04	5.1687E 04	5.1687E 04	4.7573E 05	10500
11000	1.0000	2.50000	23.3275	25.8275	4.96791	46.3596	51.3255	4.7298E 04	5.3788E 04	5.3788E 04	4.9677E 05	11000
11500	1.0000	2.50000	23.4386	25.9386	4.96791	46.5783	51.5484	4.9394E 04	5.5884E 04	5.5884E 04	5.1781E 05	11500
12000	1.0000	2.50000	23.5450	26.0450	4.96791	46.7819	51.7558	5.1486E 04	5.7976E 04	5.7976E 04	5.3884E 05	12000
12500	1.0000	2.50000	23.6471	26.1471	4.96791	46.9807	51.9586	5.3574E 04	6.0064E 04	6.0064E 04	5.5986E 05	12500
13000	1.0000	2.50000	23.7451	26.2451	4.96791	47.1855	52.1550	5.5658E 04	6.2148E 04	6.2148E 04	5.8087E 05	13000
13500	1.0000	2.50000	23.8395	26.3395	4.96791	47.3750	52.3409	5.7738E 04	6.4228E 04	6.4228E 04	6.0188E 05	13500
14000	1.0000	2.50000	23.9304	26.4304	4.96791	47.5537	52.5216	5.9813E 04	6.6303E 04	6.6303E 04	6.2289E 05	14000
14500	1.0000	2.50000	24.0181	26.5181	4.96791	47.7280	52.6959	6.1884E 04	6.8374E 04	6.8374E 04	6.4390E 05	14500
15000	1.0000	2.50000	24.1029	26.6029	4.96791	47.8984	52.8644	6.3950E 04	7.0440E 04	7.0440E 04	6.6491E 05	15000
15500	1.0000	2.50000	24.1849	26.6849	4.96791	48.0593	53.0273	6.6012E 04	7.2502E 04	7.2502E 04	6.8592E 05	15500
16000	1.0000	2.50000	24.2642	26.7642	4.96791	48.2171	53.1850	6.8070E 04	7.4560E 04	7.4560E 04	7.0693E 05	16000
16500	1.0000	2.50000	24.3412	26.8412	4.96791	48.3699	53.3379	7.0124E 04	7.6614E 04	7.6614E 04	7.2794E 05	16500
17000	1.0000	2.50000	24.4158	26.9158	4.96791	48.5182	53.4862	7.2174E 04	7.8664E 04	7.8664E 04	7.4895E 05	17000
17500	1.0000	2.50000	24.4883	26.9883	4.96791	48.6623	53.6302	7.4220E 04	8.0710E 04	8.0710E 04	7.6996E 05	17500
18000	1.0000	2.50000	24.5587	27.0587	4.96791	48.8022	53.7701	7.6262E 04	8.2752E 04	8.2752E 04	7.9097E 05	18000
18500	1.0000	2.50000	24.6272	27.1272	4.96791	48.9383	53.9062	7.8300E 04	8.4790E 04	8.4790E 04	8.1198E 05	18500
19000	1.0000	2.50000	24.6939	27.1939	4.96791	49.0708	54.0387	8.0334E 04	8.6824E 04	8.6824E 04	8.3299E 05	19000
19500	1.0000	2.50000	24.7588	27.2588	4.96791	49.1998	54.1678	8.2364E 04	8.8854E 04	8.8854E 04	8.5399E 05	19500

TABLE 27 (CONT.). IDEAL GAS FUNCTIONS FOR C 6

TEMP. (°K)	PARTIAL FUNCT.	$\frac{H^0 - H}{RT}$	$-\frac{H^0 - H}{RT}$	$S^0 - S$	$\ln \frac{H^0 - H}{RT} - \frac{S^0 - S}{R}$	$\frac{H^0 - H}{RT} - \frac{S^0 - S}{R}$	$\frac{H^0 - H}{RT} - \frac{S^0 - S}{R}$	TEMP. (°K)
20000	1.0000	2.50000	26.8771	27.3221	4.96791	49.3256	54.2939	20000
22000	1.0000	2.50000	23.0604	27.5404	4.96791	49.7991	54.7670	22000
24000	1.0000	2.50000	20.2779	27.7779	4.96791	50.2314	55.1993	24000
26000	1.0000	2.50000	18.5480	27.9780	4.96791	50.6290	55.5969	26000
28000	1.0000	2.50000	17.5633	28.1633	4.96791	50.9972	55.9651	28000
30000	1.0000	2.50000	16.8358	28.3358	4.96791	51.3399	56.3079	30000
32000	1.0000	2.50000	16.2971	28.4971	4.96791	51.6604	56.6285	32000
34000	1.0000	2.50000	15.8987	28.6487	4.96791	51.9717	56.9297	34000
36000	1.0000	2.50000	15.5816	28.7916	4.96791	52.2747	57.2136	36000
40000	1.0000	2.50000	15.4267	28.9267	4.96791	52.5143	57.4822	40000
42000	1.0000	2.50000	15.5550	29.0550	4.96791	52.7691	57.7370	42000
44000	1.0000	2.50000	15.6789	29.1789	4.96791	53.0115	57.9794	44000
46000	1.0000	2.50000	15.7932	29.2932	4.96791	53.2426	58.2105	46000
48000	1.0000	2.50000	15.9044	29.4044	4.96791	53.4634	58.4314	48000
50000	1.0000	2.50000	16.0108	29.5108	4.96791	53.6749	58.6426	50000
60000	1.0000	2.50000	17.1128	29.6128	4.96791	53.8777	58.8456	60000
70000	1.0000	2.50000	17.5686	30.0686	4.96791	54.7834	59.7513	70000
80000	1.0000	2.50000	17.9540	30.4540	4.96791	55.5492	60.5172	80000
90000	1.0000	2.50000	18.2878	30.7878	4.96791	56.2125	61.1805	90000
100000	1.0000	2.50000	18.5823	31.0823	4.96791	56.7918	61.7657	100000
150000	1.0000	2.50000	28.8457	31.3457	4.96791	57.3212	62.2891	150000
200000	1.0000	2.50000	29.8594	32.3594	4.96791	59.3355	64.3034	200000
300000	1.0000	2.50000	30.5784	33.0784	4.96791	60.7447	65.7126	300000
400000	1.0000	2.50000	31.5922	34.0922	4.96791	62.7790	67.7469	400000
500000	1.0000	2.50000	32.3114	34.8114	4.96791	64.2082	69.1761	500000
600000	1.0000	2.50000	32.8493	35.3493	4.96791	65.3167	70.2846	600000
700000	1.0000	2.50000	33.251	35.751	4.96791	66.2253	71.1904	700000
800000	1.0000	2.50000	34.0443	36.5443	4.96791	67.6517	72.6166	800000
900000	1.0000	2.50000	34.6022	37.1022	4.96791	68.7602	73.7281	900000
1000000	1.0000	2.50000	35.6158	38.1158	4.96791	70.7745	75.7424	1000000
1500000	1.0000	2.50000	36.3350	38.8350	4.96791	72.2037	77.1716	1500000
2000000	1.0000	2.50000	37.3487	39.8487	4.96791	74.2180	79.1859	2000000
3000000	1.0000	2.50000	38.0679	40.5679	4.96791	75.6472	80.6151	3000000
4000000	1.0000	2.50000	38.6258	41.1258	4.96791	76.7558	81.7237	4000000
5000000	1.0000	2.50000	39.0816	41.5816	4.96791	77.6613	82.6294	5000000
6000000	1.0000	2.50000	39.8008	42.3008	4.96791	79.0907	84.0586	6000000
7000000	1.0000	2.50000	40.3486	42.8486	4.96791	80.1993	85.1672	7000000
8000000	1.0000	2.50000						8000000
9000000	1.0000	2.50000						9000000
10000000	1.0000	2.50000						10000000

TABLE 20. IDEAL GAS FUNCTIONS FOR N 6+ (ATOMIC WEIGHT 14.0034, R = 1.98717 CAL/MOLE) BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 71 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{U^0-E^0}{RT}$	$\frac{U^0-E^0}{T}$	S/R	$\ln \frac{U^0-E^0}{T} - \frac{U^0-E^0}{T}$	$\ln \frac{U^0-E^0}{T} - \frac{U^0-E^0}{T} - \frac{S}{R}$	$\ln \frac{U^0-E^0}{T} - \frac{U^0-E^0}{T} - \frac{S}{R} - \frac{S^0}{R}$	$\ln \frac{U^0-E^0}{T} - \frac{U^0-E^0}{T} - \frac{S}{R} - \frac{S^0}{R} - \frac{S^0}{R}$	$\ln \frac{U^0-E^0}{T} - \frac{U^0-E^0}{T} - \frac{S}{R} - \frac{S^0}{R} - \frac{S^0}{R} - \frac{S^0}{R}$	TEMP. (°K)
5000	2.0000	22.2801	24.7801	4.96791	49.2743	49.2442	1.4904E 04	2.4440E 04	2.2137E 05	5000
5200	2.0000	22.3762	24.8791	4.96791	49.4371	49.4069	1.5500E 04	2.5833E 04	2.3124E 05	5200
5400	2.0000	22.4725	24.9725	4.96791	49.6066	49.6245	1.6094E 04	2.6827E 04	2.4115E 05	5400
5600	2.0000	22.5634	25.0634	4.96791	49.7833	49.8062	1.6692E 04	2.7820E 04	2.5109E 05	5600
5800	2.0000	22.6512	25.1512	4.96791	49.9616	49.9795	1.7288E 04	2.8814E 04	2.6107E 05	5800
6000	2.0000	22.7359	25.2359	4.96791	50.1400	50.1480	1.7884E 04	2.9807E 04	2.7108E 05	6000
6200	2.0000	22.8179	25.3179	4.96791	50.3189	50.3109	1.8481E 04	3.0801E 04	2.8113E 05	6200
6400	2.0000	22.8973	25.3973	4.96791	50.4986	50.4886	1.9077E 04	3.1795E 04	2.9120E 05	6400
6600	2.0000	22.9742	25.4742	4.96791	50.6755	50.6655	1.9673E 04	3.2788E 04	3.0131E 05	6600
6800	2.0000	23.0478	25.5488	4.96791	50.8501	50.8398	2.0269E 04	3.3782E 04	3.1145E 05	6800
7000	2.0000	23.1213	25.6213	4.96791	51.0238	51.0138	2.0859E 04	3.4775E 04	3.2162E 05	7000
7200	2.0000	23.1917	25.6917	4.96791	51.1957	51.1857	2.1446E 04	3.5768E 04	3.3182E 05	7200
7400	2.0000	23.2602	25.7602	4.96791	51.3658	51.3558	2.2030E 04	3.6760E 04	3.4204E 05	7400
7600	2.0000	23.3269	25.8269	4.96791	51.5344	51.5243	2.2614E 04	3.7754E 04	3.5229E 05	7600
7800	2.0000	23.3918	25.8918	4.96791	51.7016	51.6914	2.3200E 04	3.8750E 04	3.6257E 05	7800
8000	2.0000	23.4551	25.9551	4.96791	51.8672	51.8571	2.3786E 04	3.9747E 04	3.7287E 05	8000
8200	2.0000	23.5169	26.0169	4.96791	52.0319	52.0218	2.4372E 04	4.0737E 04	3.8320E 05	8200
8400	2.0000	23.5771	26.0771	4.96791	52.1956	52.1855	2.4958E 04	4.1724E 04	3.9356E 05	8400
8600	2.0000	23.6359	26.1359	4.96791	52.3585	52.3484	2.5544E 04	4.2712E 04	4.0395E 05	8600
8800	2.0000	23.6934	26.1934	4.96791	52.5207	52.5106	2.6131E 04	4.3701E 04	4.1435E 05	8800
9000	2.0000	23.7496	26.2496	4.96791	52.6823	52.6723	2.6718E 04	4.4691E 04	4.2476E 05	9000
9200	2.0000	23.8045	26.3045	4.96791	52.8433	52.8333	2.7305E 04	4.5682E 04	4.3519E 05	9200
9400	2.0000	23.8583	26.3583	4.96791	53.0037	52.9937	2.7892E 04	4.6674E 04	4.4564E 05	9400
9600	2.0000	23.9109	26.4109	4.96791	53.1635	53.1535	2.8479E 04	4.7667E 04	4.5614E 05	9600
9800	2.0000	23.9625	26.4625	4.96791	53.3227	53.3127	2.9067E 04	4.8660E 04	4.6665E 05	9800
10000	2.0000	24.0130	26.5130	4.96791	53.4813	53.4713	2.9655E 04	4.9657E 04	4.7718E 05	10000
10500	2.0000	24.1350	26.6350	4.96791	53.7943	53.7843	3.0842E 04	5.1246E 04	5.0354E 05	10500
11000	2.0000	24.2512	26.7512	4.96791	54.1033	54.0933	3.2028E 04	5.2836E 04	5.3010E 05	11000
11500	2.0000	24.3624	26.8624	4.96791	54.4121	54.4021	3.3214E 04	5.4427E 04	5.5674E 05	11500
12000	2.0000	24.4688	26.9688	4.96791	54.7207	54.7107	3.4400E 04	5.6019E 04	5.8340E 05	12000
12500	2.0000	24.5709	27.0709	4.96791	55.0291	55.0191	3.5586E 04	5.7612E 04	6.1033E 05	12500
13000	2.0000	24.6689	27.1689	4.96791	55.3375	55.3275	3.6772E 04	5.9206E 04	6.3728E 05	13000
13500	2.0000	24.7633	27.2633	4.96791	55.6458	55.6358	3.7958E 04	6.0801E 04	6.6432E 05	13500
14000	2.0000	24.8542	27.3542	4.96791	55.9541	55.9441	3.9144E 04	6.2396E 04	6.9145E 05	14000
14500	2.0000	24.9419	27.4419	4.96791	56.2623	56.2523	4.0330E 04	6.4000E 04	7.1867E 05	14500
15000	2.0000	25.0267	27.5267	4.96791	56.5705	56.5605	4.1516E 04	6.5604E 04	7.4598E 05	15000
15500	2.0000	25.1086	27.6086	4.96791	56.8787	56.8687	4.2702E 04	6.7208E 04	7.7337E 05	15500
16000	2.0000	25.1880	27.6880	4.96791	57.1869	57.1769	4.3888E 04	6.8812E 04	8.0084E 05	16000
16500	2.0000	25.2649	27.7649	4.96791	57.4951	57.4851	4.5074E 04	7.0416E 04	8.2839E 05	16500
17000	2.0000	25.3396	27.8396	4.96791	57.8033	57.7933	4.6260E 04	7.2020E 04	8.5602E 05	17000
17500	2.0000	25.4120	27.9120	4.96791	58.1115	58.1015	4.7446E 04	7.3624E 04	8.8371E 05	17500
18000	2.0000	25.4825	27.9825	4.96791	58.4197	58.4097	4.8632E 04	7.5228E 04	9.1148E 05	18000
18500	2.0000	25.5510	28.0510	4.96791	58.7279	58.7179	4.9818E 04	7.6832E 04	9.3932E 05	18500
19000	2.0000	25.6176	28.1176	4.96791	59.0361	59.0261	5.1004E 04	7.8436E 04	9.6722E 05	19000
19500	2.0000	25.6826	28.1826	4.96791	59.3443	59.3343	5.2190E 04	8.0040E 04	9.9519E 05	19500

TABLE 28 (CONT.). IDEAL GAS FUNCTIONS FOR  $N_2$  +[illegible]

TABLE 29. IDEAL GAS FUNCTIONS FOR O<sup>+</sup> (ATOMIC WEIGHT 15.9946, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 72 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2 - E_0}{RT}$	$-\frac{E - E_0}{RT}$	$S/R$	$(h^2 - E_0)/RT - \frac{E - E_0}{RT}$	$S$	$E - E_0$	$h^2 - E_0$	$h^2 - E_0$	$h^2 - E_0$	TEMP. (°K)
5000	1.0000	2.50000	21.7865	24.2845	4.7865	48.2614	1.4944E 04	2.5840E 04	2.5840E 04	2.1647E 05	5000
5200	1.0000	2.50000	21.8846	24.3846	4.8846	48.3562	1.5500E 04	2.5833E 04	2.5833E 04	2.2614E 05	5200
5400	1.0000	2.50000	21.9789	24.4789	4.9789	48.4437	1.6096E 04	2.5827E 04	2.5827E 04	2.3580E 05	5400
5600	1.0000	2.50000	22.0699	24.5699	5.0699	48.5265	1.6679E 04	2.5822E 04	2.5822E 04	2.4540E 05	5600
5800	1.0000	2.50000	22.1576	24.6576	5.1576	48.6057	1.7208E 04	2.5816E 04	2.5816E 04	2.5530E 05	5800
6000	1.0000	2.50000	22.2423	24.7423	5.2423	48.6791	1.7694E 04	2.5807E 04	2.5807E 04	2.6520E 05	6000
6200	1.0000	2.50000	22.3243	24.8243	5.3243	48.7461	1.8141E 04	2.5796E 04	2.5796E 04	2.7500E 05	6200
6400	1.0000	2.50000	22.4037	24.9037	5.4037	48.8078	1.8551E 04	2.5783E 04	2.5783E 04	2.8470E 05	6400
6600	1.0000	2.50000	22.4806	24.9806	5.4806	48.8646	1.8927E 04	2.5768E 04	2.5768E 04	2.9430E 05	6600
6800	1.0000	2.50000	22.5553	25.0553	5.5553	48.9169	1.9269E 04	2.5752E 04	2.5752E 04	3.0390E 05	6800
7000	1.0000	2.50000	22.6277	25.1277	5.6277	48.9646	1.9579E 04	2.5735E 04	2.5735E 04	3.1340E 05	7000
7200	1.0000	2.50000	22.6982	25.1982	5.6982	49.0079	1.9859E 04	2.5717E 04	2.5717E 04	3.2280E 05	7200
7400	1.0000	2.50000	22.7667	25.2667	5.7667	49.0471	2.0109E 04	2.5698E 04	2.5698E 04	3.3210E 05	7400
7600	1.0000	2.50000	22.8333	25.3333	5.8333	49.0815	2.0334E 04	2.5678E 04	2.5678E 04	3.4140E 05	7600
7800	1.0000	2.50000	22.8983	25.3983	5.8983	49.1115	2.0536E 04	2.5657E 04	2.5657E 04	3.5060E 05	7800
8000	1.0000	2.50000	22.9616	25.4616	5.9616	49.1379	2.0715E 04	2.5635E 04	2.5635E 04	3.5970E 05	8000
8200	1.0000	2.50000	23.0233	25.5233	6.0233	49.1609	2.0873E 04	2.5612E 04	2.5612E 04	3.6870E 05	8200
8400	1.0000	2.50000	23.0835	25.5835	6.0835	49.1805	2.1011E 04	2.5588E 04	2.5588E 04	3.7760E 05	8400
8600	1.0000	2.50000	23.1424	25.6424	6.1424	49.1969	2.1130E 04	2.5563E 04	2.5563E 04	3.8640E 05	8600
8800	1.0000	2.50000	23.1998	25.6998	6.1998	49.2101	2.1231E 04	2.5537E 04	2.5537E 04	3.9510E 05	8800
9000	1.0000	2.50000	23.2560	25.7560	6.2560	49.2201	2.1315E 04	2.5510E 04	2.5510E 04	4.0370E 05	9000
9200	1.0000	2.50000	23.3110	25.8110	6.3110	49.2279	2.1383E 04	2.5482E 04	2.5482E 04	4.1220E 05	9200
9400	1.0000	2.50000	23.3647	25.8647	6.3647	49.2326	2.1436E 04	2.5453E 04	2.5453E 04	4.2060E 05	9400
9600	1.0000	2.50000	23.4174	25.9174	6.4174	49.2352	2.1475E 04	2.5423E 04	2.5423E 04	4.2890E 05	9600
9800	1.0000	2.50000	23.4689	25.9689	6.4689	49.2358	2.1500E 04	2.5392E 04	2.5392E 04	4.3710E 05	9800
10000	1.0000	2.50000	23.5194	26.0194	6.5194	49.2345	2.1512E 04	2.5360E 04	2.5360E 04	4.4520E 05	10000
10500	1.0000	2.50000	23.6416	26.1416	6.6416	49.2301	2.1500E 04	2.5327E 04	2.5327E 04	4.5320E 05	10500
11000	1.0000	2.50000	23.7577	26.2577	6.7577	49.2239	2.1475E 04	2.5292E 04	2.5292E 04	4.6110E 05	11000
11500	1.0000	2.50000	23.8688	26.3688	6.8688	49.2161	2.1436E 04	2.5256E 04	2.5256E 04	4.6890E 05	11500
12000	1.0000	2.50000	23.9752	26.4752	6.9752	49.2069	2.1383E 04	2.5219E 04	2.5219E 04	4.7660E 05	12000
12500	1.0000	2.50000	24.0773	26.5773	7.0773	49.1965	2.1315E 04	2.5182E 04	2.5182E 04	4.8420E 05	12500
13000	1.0000	2.50000	24.1753	26.6753	7.1753	49.1849	2.1231E 04	2.5143E 04	2.5143E 04	4.9170E 05	13000
13500	1.0000	2.50000	24.2697	26.7697	7.2697	49.1721	2.1130E 04	2.5103E 04	2.5103E 04	4.9910E 05	13500
14000	1.0000	2.50000	24.3606	26.8606	7.3606	49.1581	2.1011E 04	2.5062E 04	2.5062E 04	5.0640E 05	14000
14500	1.0000	2.50000	24.4483	26.9483	7.4483	49.1429	2.0873E 04	2.5019E 04	2.5019E 04	5.1360E 05	14500
15000	1.0000	2.50000	24.5331	27.0331	7.5331	49.1265	2.0715E 04	2.4974E 04	2.4974E 04	5.2070E 05	15000
15500	1.0000	2.50000	24.6151	27.1151	7.6151	49.1090	2.0536E 04	2.4927E 04	2.4927E 04	5.2770E 05	15500
16000	1.0000	2.50000	24.6944	27.1944	7.6944	49.0905	2.0334E 04	2.4878E 04	2.4878E 04	5.3460E 05	16000
16500	1.0000	2.50000	24.7714	27.2714	7.7714	49.0711	2.0109E 04	2.4827E 04	2.4827E 04	5.4140E 05	16500
17000	1.0000	2.50000	24.8460	27.3460	7.8460	49.0508	1.9859E 04	2.4774E 04	2.4774E 04	5.4810E 05	17000
17500	1.0000	2.50000	24.9185	27.4185	7.9185	49.0295	1.9579E 04	2.4719E 04	2.4719E 04	5.5470E 05	17500
18000	1.0000	2.50000	24.9889	27.4889	7.9889	49.0071	1.9269E 04	2.4662E 04	2.4662E 04	5.6120E 05	18000
18500	1.0000	2.50000	25.0574	27.5574	8.0574	48.9836	1.8927E 04	2.4603E 04	2.4603E 04	5.6760E 05	18500
19000	1.0000	2.50000	25.1240	27.6240	8.1240	48.9591	1.8551E 04	2.4542E 04	2.4542E 04	5.7390E 05	19000
19500	1.0000	2.50000	25.1890	27.6890	8.1890	48.9336	1.8141E 04	2.4479E 04	2.4479E 04	5.8010E 05	19500



TABLE 29 (CONT.). IDEAL GAS FUNCTIONS FOR O<sub>2</sub>

TEMP. (°K)	PARTIT. FUNCT.	$\frac{U^0-E^0}{RT}$	$\frac{S^0-E^0}{RT}$	$\ln \frac{U^0-E^0}{RT} - \frac{S^0-E^0}{RT}$	$\frac{S^0-E^0}{RT} - \frac{S^0-E^0}{RT}$	$\frac{S^0-E^0}{RT} - \frac{S^0-E^0}{RT}$	$\frac{S^0-E^0}{RT} - \frac{S^0-E^0}{RT}$	$\frac{S^0-E^0}{RT} - \frac{S^0-E^0}{RT}$	TEMP. (°K)
20000	1.0000	2.50000	25.2523	4.96791	50.1805	55.1486	5.9612E 04	9.3358E 04	1.0034E 06
22000	1.0000	2.50000	25.4706	4.96791	50.5840	55.5519	5.9576E 04	9.3292E 05	1.1144E 06
24000	1.0000	2.50000	25.7081	4.96791	51.0862	56.0541	5.9538E 04	9.3228E 05	1.2281E 06
26000	1.0000	2.50000	25.9682	4.96791	51.6839	56.6518	5.9499E 04	9.3167E 05	1.3486E 06
28000	1.0000	2.50000	26.2500	4.96791	52.3791	57.3469	5.9461E 04	9.3108E 05	1.4751E 06
30000	1.0000	2.50000	26.5539	4.96791	53.1765	58.1543	5.9422E 04	9.3050E 05	1.6076E 06
32000	1.0000	2.50000	26.8800	4.96791	54.0894	59.0737	5.9383E 04	9.2997E 05	1.7461E 06
34000	1.0000	2.50000	27.2273	4.96791	55.1165	60.1094	5.9344E 04	9.2942E 05	1.8906E 06
36000	1.0000	2.50000	27.5969	4.96791	56.2646	61.2615	5.9305E 04	9.2887E 05	2.0421E 06
38000	1.0000	2.50000	28.0000	4.96791	57.5377	62.5346	5.9266E 04	9.2832E 05	2.2016E 06
40000	1.0000	2.50000	28.4473	4.96791	58.9418	63.9387	5.9227E 04	9.2777E 05	2.3691E 06
42000	1.0000	2.50000	28.9300	4.96791	60.4839	65.4808	5.9188E 04	9.2722E 05	2.5446E 06
44000	1.0000	2.50000	29.4473	4.96791	62.1700	67.1669	5.9149E 04	9.2667E 05	2.7281E 06
46000	1.0000	2.50000	29.9900	4.96791	63.9961	68.9930	5.9110E 04	9.2612E 05	2.9196E 06
48000	1.0000	2.50000	30.6673	4.96791	65.9672	70.9641	5.9071E 04	9.2557E 05	3.1191E 06
50000	1.0000	2.50000	31.7759	4.96791	68.0803	73.1772	5.9032E 04	9.2502E 05	3.3276E 06
52000	1.0000	2.50000	32.7895	4.96791	70.3324	75.5303	5.8993E 04	9.2447E 05	3.5441E 06
54000	1.0000	2.50000	33.5087	4.96791	72.7245	78.0224	5.8954E 04	9.2392E 05	3.7686E 06
56000	1.0000	2.50000	34.0224	4.96791	75.2566	80.6545	5.8915E 04	9.2337E 05	3.9991E 06
58000	1.0000	2.50000	34.2224	4.96791	77.9287	83.4266	5.8876E 04	9.2282E 05	4.2356E 06
60000	1.0000	2.50000	34.2224	4.96791	80.7408	86.3387	5.8837E 04	9.2227E 05	4.4781E 06
62000	1.0000	2.50000	34.0224	4.96791	83.6929	89.3908	5.8798E 04	9.2172E 05	4.7266E 06
64000	1.0000	2.50000	33.7416	4.96791	86.7850	92.5829	5.8759E 04	9.2117E 05	4.9811E 06
66000	1.0000	2.50110	33.2996	4.97011	90.0171	95.9150	5.8720E 04	9.2062E 05	5.2416E 06
68000	1.0000	2.50859	32.7566	4.98458	93.4892	99.4871	5.8681E 04	9.2007E 05	5.5081E 06
70000	1.0131	2.61156	32.0475	5.10960	97.2003	103.2983	5.8642E 04	9.1952E 05	5.7806E 06
72000	1.0749	2.99107	31.1046	5.95375	101.1524	107.3004	5.8603E 04	9.1897E 05	6.0591E 06
74000	1.8110	4.66567	30.0462	7.27145	105.3425	111.4905	5.8564E 04	9.1842E 05	6.3436E 06
76000	3.7407	5.19317	30.0462	10.31969	109.7746	115.9226	5.8525E 04	9.1787E 05	6.6341E 06
78000	10.4083	4.74413	40.1215	47.8656	157.6367	162.3788	5.8486E 04	9.1732E 05	6.9306E 06
80000	18.5346	4.27234	41.4177	45.6901	162.9008	168.1009	5.8447E 04	9.1677E 05	7.2331E 06
82000	26.5216	3.94732	42.3339	44.2812	168.1009	173.1010	5.8408E 04	9.1622E 05	7.5416E 06
84000	33.8019	3.71907	43.0323	46.7513	173.1010	178.1011	5.8369E 04	9.1567E 05	7.8551E 06
86000	45.9246	3.42424	44.0379	47.4822	178.1011	183.1012	5.8330E 04	9.1512E 05	8.1736E 06
88000	55.2771	3.24339	44.8012	48.0446	183.1012	188.1013	5.8291E 04	9.1457E 05	8.4971E 06
90000									
92000									
94000									
96000									
98000									
100000									

TABLE 10. IDEAL GAS FUNCTIONS FOR AN  $\epsilon_0$  (ATOMIC WEIGHT 39.948,  $R = 1.98717$  CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 73 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	TEMP. (°K)
5000	1.0000	2.50000	23.1593	29.6193	4.96791	46.9271	51.8950	1.4904E 04	2.4840E 04	2.3011E 05
5200	1.0000	2.50000	23.2573	29.7573	4.96791	47.0271	52.0579	1.5004E 04	2.4930E 04	2.4011E 05
5400	1.0000	2.50000	23.3517	29.8517	4.96791	47.1271	52.2154	1.5094E 04	2.5020E 04	2.5000E 05
5600	1.0000	2.50000	23.4426	29.9426	4.96791	47.2271	52.3685	1.5184E 04	2.5110E 04	2.6000E 05
5800	1.0000	2.50000	23.5303	30.0303	4.96791	47.3271	52.5168	1.5274E 04	2.5200E 04	2.7000E 05
6000	1.0000	2.50000	23.6151	30.1151	4.96791	47.4271	52.6608	1.5364E 04	2.5290E 04	2.8000E 05
6200	1.0000	2.50000	23.6971	30.1971	4.96791	47.5271	52.8008	1.5454E 04	2.5380E 04	2.9000E 05
6400	1.0000	2.50000	23.7764	30.2764	4.96791	47.6271	52.9369	1.5544E 04	2.5470E 04	3.0000E 05
6600	1.0000	2.50000	23.8534	30.3534	4.96791	47.7271	53.0694	1.5634E 04	2.5560E 04	3.1000E 05
6800	1.0000	2.50000	23.9280	30.4280	4.96791	47.8271	53.1984	1.5724E 04	2.5650E 04	3.2000E 05
7000	1.0000	2.50000	24.0005	30.5005	4.96791	47.9271	53.3242	1.5814E 04	2.5740E 04	3.3000E 05
7200	1.0000	2.50000	24.0709	30.5709	4.96791	48.0271	53.4468	1.5904E 04	2.5830E 04	3.4000E 05
7400	1.0000	2.50000	24.1394	30.6394	4.96791	48.1271	53.5668	1.6004E 04	2.5920E 04	3.5000E 05
7600	1.0000	2.50000	24.2061	30.7061	4.96791	48.2271	53.6844	1.6094E 04	2.6010E 04	3.6000E 05
7800	1.0000	2.50000	24.2710	30.7710	4.96791	48.3271	53.7977	1.6184E 04	2.6100E 04	3.7000E 05
8000	1.0000	2.50000	24.3343	30.8343	4.96791	48.4271	53.9093	1.6274E 04	2.6190E 04	3.8000E 05
8200	1.0000	2.50000	24.3960	30.8960	4.96791	48.5271	54.0185	1.6364E 04	2.6280E 04	3.9000E 05
8400	1.0000	2.50000	24.4563	30.9563	4.96791	48.6271	54.1253	1.6454E 04	2.6370E 04	4.0000E 05
8600	1.0000	2.50000	24.5151	31.0151	4.96791	48.7271	54.2299	1.6544E 04	2.6460E 04	4.1000E 05
8800	1.0000	2.50000	24.5726	31.0726	4.96791	48.8271	54.3324	1.6634E 04	2.6550E 04	4.2000E 05
9000	1.0000	2.50000	24.6287	31.1287	4.96791	48.9271	54.4328	1.6724E 04	2.6640E 04	4.3000E 05
9200	1.0000	2.50000	24.6837	31.1837	4.96791	49.0271	54.5309	1.6814E 04	2.6730E 04	4.4000E 05
9400	1.0000	2.50000	24.7375	31.2375	4.96791	49.1271	54.6269	1.6904E 04	2.6820E 04	4.5000E 05
9600	1.0000	2.50000	24.7901	31.2901	4.96791	49.2271	54.7209	1.6994E 04	2.6910E 04	4.6000E 05
9800	1.0000	2.50000	24.8415	31.3415	4.96791	49.3271	54.8129	1.7084E 04	2.7000E 04	4.7000E 05
10000	1.0000	2.50000	24.8922	31.3922	4.96791	49.4271	54.9029	1.7174E 04	2.7090E 04	4.8000E 05
10500	1.0000	2.50000	25.0141	31.5141	4.96791	49.5271	55.0909	1.7264E 04	2.7180E 04	4.9000E 05
11000	1.0000	2.50000	25.1304	31.6304	4.96791	49.6271	55.2769	1.7354E 04	2.7270E 04	5.0000E 05
11500	1.0000	2.50000	25.2416	31.7416	4.96791	49.7271	55.4609	1.7444E 04	2.7360E 04	5.1000E 05
12000	1.0000	2.50000	25.3480	31.8480	4.96791	49.8271	55.6429	1.7534E 04	2.7450E 04	5.2000E 05
12500	1.0000	2.50000	25.4500	31.9500	4.96791	49.9271	55.8229	1.7624E 04	2.7540E 04	5.3000E 05
13000	1.0000	2.50000	25.5481	32.0481	4.96791	50.0271	56.0009	1.7714E 04	2.7630E 04	5.4000E 05
13500	1.0000	2.50000	25.6425	32.1425	4.96791	50.1271	56.1769	1.7804E 04	2.7720E 04	5.5000E 05
14000	1.0000	2.50000	25.7334	32.2334	4.96791	50.2271	56.3509	1.7894E 04	2.7810E 04	5.6000E 05
14500	1.0000	2.50000	25.8212	32.3212	4.96791	50.3271	56.5229	1.7984E 04	2.7900E 04	5.7000E 05
15000	1.0000	2.50000	25.9060	32.4060	4.96791	50.4271	56.6929	1.8074E 04	2.7990E 04	5.8000E 05
15500	1.0000	2.50000	25.9880	32.4880	4.96791	50.5271	56.8609	1.8164E 04	2.8080E 04	5.9000E 05
16000	1.0000	2.50000	26.0675	32.5675	4.96791	50.6271	57.0269	1.8254E 04	2.8170E 04	6.0000E 05
16500	1.0000	2.50000	26.1445	32.6445	4.96791	50.7271	57.1909	1.8344E 04	2.8260E 04	6.1000E 05
17000	1.0000	2.50000	26.2193	32.7193	4.96791	50.8271	57.3529	1.8434E 04	2.8350E 04	6.2000E 05
17500	1.0000	2.50000	26.2919	32.7919	4.96791	50.9271	57.5129	1.8524E 04	2.8440E 04	6.3000E 05
18000	1.0000	2.50000	26.3626	32.8626	4.96791	51.0271	57.6709	1.8614E 04	2.8530E 04	6.4000E 05
18500	1.0000	2.50000	26.4313	32.9313	4.96791	51.1271	57.8269	1.8704E 04	2.8620E 04	6.5000E 05
19000	1.0000	2.50000	26.4983	32.9983	4.96791	51.2271	57.9809	1.8794E 04	2.8710E 04	6.6000E 05
19500	1.0000	2.50000	26.5636	33.0636	4.96791	51.3271	58.1329	1.8884E 04	2.8800E 04	6.7000E 05

TABLE 30 (CONT.). IDEAL GAS FUNCTIONS FOR AR 6+

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2}{RT}$	$-\frac{h^2}{RT}$	$\ln \frac{h^2}{RT}$	$-\ln \frac{h^2}{RT}$	$\ln \frac{h^2}{RT}$	$-\ln \frac{h^2}{RT}$	$\ln \frac{h^2}{RT}$	$-\ln \frac{h^2}{RT}$	TEMP. (°K)
20000	1.0024	2.51945	26.6274	5.00554	52.9130	57.9195	6.0380E 04	1.0013E 05	1.0583E 06	20000
22000	1.0050	2.53749	26.8643	5.04242	53.3917	58.4341	6.7216E 04	1.1093E 05	1.1746E 06	22000
24000	1.0094	2.56427	27.0902	5.09462	53.8326	58.9282	7.4403E 04	1.2229E 05	1.2920E 06	24000
26000	1.0160	2.60062	27.2968	5.16787	54.2432	59.4111	8.2698E 04	1.3434E 05	1.4103E 06	26000
28000	1.0252	2.64671	27.4911	5.25945	54.6294	59.8889	9.1624E 04	1.4726E 05	1.5294E 06	28000
30000	1.0376	2.70204	27.6794	5.36940	54.9959	60.3653	1.0147E 05	1.6108E 05	1.6679E 06	30000
32000	1.0533	2.76862	27.8519	5.49374	55.3464	60.8422	1.1227E 05	1.7584E 05	1.7711E 06	32000
34000	1.0726	2.83614	28.0217	5.63568	55.6837	61.3196	1.2404E 05	1.9162E 05	1.8932E 06	34000
36000	1.0958	2.91216	28.1859	5.78695	56.0101	61.7971	1.3679E 05	2.0833E 05	2.0164E 06	36000
38000	1.1228	2.99226	28.3455	5.94611	56.3272	62.2733	1.5044E 05	2.2595E 05	2.1484E 06	38000
40000	1.1540	3.07513	28.5011	6.11079	56.6364	62.7472	1.6495E 05	2.4443E 05	2.2855E 06	40000
42000	1.1892	3.15968	28.6532	6.27881	56.9386	63.2174	1.8025E 05	2.6371E 05	2.4284E 06	42000
44000	1.2287	3.24502	28.8021	6.44938	57.2346	63.6830	1.9629E 05	2.8373E 05	2.5763E 06	44000
46000	1.2725	3.33045	28.9483	6.61816	57.5250	64.1431	2.1303E 05	3.0444E 05	2.7284E 06	46000
48000	1.3206	3.41549	29.0918	6.78715	57.8102	64.5974	2.3040E 05	3.2578E 05	2.8841E 06	48000
50000	1.3733	3.49976	29.2329	6.95641	58.0907	65.0453	2.4837E 05	3.4773E 05	3.0445E 06	50000
60000	1.7084	3.90172	29.9071	7.75336	59.4304	67.1838	3.4597E 05	4.6520E 05	3.5458E 06	60000
70000	2.1792	4.25493	30.5359	8.45525	60.6798	69.1351	4.5237E 05	5.9187E 05	4.2474E 06	70000
80000	2.6084	4.57900	31.1234	9.01755	61.8473	70.8649	5.6243E 05	7.2140E 05	4.9678E 06	80000
90000	3.6151	4.73960	31.6703	9.41836	62.9342	72.3525	6.8881E 05	8.6765E 05	5.8441E 06	90000
100000	4.6097	4.84475	32.1768	9.66705	63.9406	73.6076	7.6799E 05	9.6671E 05	6.3941E 06	100000
150000	12.2684	4.84697	34.1693	9.63172	67.9001	77.5318	1.1467E 06	1.4448E 06	1.0185E 07	150000
200000	23.1530	4.56943	35.5236	9.04047	70.5913	79.6317	1.4107E 06	1.8008E 06	1.4110E 07	200000
300000	46.1000	4.05924	37.2484	8.12777	80.6359	82.1249	1.8230E 06	2.4199E 06	2.2218E 07	300000
400000	71.9194	3.74465	38.3899	7.66124	76.2871	83.7283	2.1816E 06	2.9745E 06	3.0515E 07	400000
500000	92.6782	3.53318	39.2013	7.02100	77.8995	84.9206	2.5169E 06	3.5105E 06	3.8920E 07	500000
600000	110.3281	3.38235	39.5315	6.72129	79.1517	85.8720	2.8405E 06	4.0328E 06	4.7491E 07	600000
800000	136.0279	3.18232	40.7747	6.32379	81.0260	87.3498	3.4893E 06	5.0590E 06	6.4821E 07	800000
1000000	158.4085	3.05594	41.6703	6.07267	82.4083	88.4809	4.0855E 06	5.0727E 06	8.2500E 07	1000000
1500000	191.0945	2.87977	42.6715	5.72259	84.7953	90.5179	5.6031E 06	8.5833E 06	1.2719E 08	1500000
2000000	210.2490	2.78831	43.4862	5.54084	86.8143	91.9552	7.1073E 06	1.1082E 07	1.7283E 08	2000000
3000000	231.5931	2.69455	44.5966	5.35452	88.6208	93.9753	1.0102E 07	1.6064E 07	2.6586E 08	3000000
4000000	243.1718	2.64680	45.3466	5.29943	90.1439	95.4066	1.3090E 07	2.1039E 07	3.6059E 08	4000000
5000000	250.4106	2.61787	45.9519	5.20214	91.3139	96.5161	1.6075E 07	2.6011E 07	4.5657E 08	5000000
6000000	255.4049	2.59846	46.4273	5.16357	92.2588	97.4223	1.9058E 07	3.0981E 07	5.5355E 08	6000000
8000000	261.7795	2.57407	47.1712	5.11510	93.7369	98.8520	2.5023E 07	4.0921E 07	7.6990E 08	8000000
10000000	265.6839	2.55936	47.7439	5.08588	94.8750	99.9408	3.0987E 07	5.0859E 07	9.4475E 08	10000000

TABLE 31. IDEAL GAS FUNCTIONS FOR N<sub>2</sub> (ATOMIC WEIGHT 14.0078, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS M.S.A.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT} - \frac{E^0-E_0}{RT}$	$S^0/R$	$\ln \frac{h^2-E_0}{RT} - \frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT} - \frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT} - \frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT} - \frac{h^2-E_0}{RT}$	TEMP. (°K)
5000	1.0000	2.50000	21.5849	24.0849	4.96791	42.8968	47.8647	1.4904E 04	5000
5200	1.0000	2.50000	21.6850	24.1850	4.96791	43.0916	48.0595	1.5500E 04	5200
5400	1.0000	2.50000	21.7793	24.2793	4.96791	43.2791	48.2470	1.6099E 04	5400
5600	1.0000	2.50000	21.8702	24.3702	4.96791	43.4598	48.4277	1.6692E 04	5600
5800	1.0000	2.50000	21.9580	24.4580	4.96791	43.6341	48.6020	1.7288E 04	5800
6000	1.0000	2.50000	22.0427	24.5427	4.96791	43.8025	48.7704	1.7884E 04	6000
6200	1.0000	2.50000	22.1247	24.6247	4.96791	43.9654	48.9333	1.8481E 04	6200
6400	1.0000	2.50000	22.2041	24.7041	4.96791	44.1231	49.0911	1.9077E 04	6400
6600	1.0000	2.50000	22.2810	24.7810	4.96791	44.2760	49.2439	1.9673E 04	6600
6800	1.0000	2.50000	22.3556	24.8556	4.96791	44.4243	49.3922	2.0269E 04	6800
7000	1.0000	2.50000	22.4281	24.9281	4.96791	44.5683	49.5362	2.0865E 04	7000
7200	1.0000	2.50000	22.4985	24.9985	4.96791	44.7083	49.6762	2.1461E 04	7200
7400	1.0000	2.50000	22.5670	25.0670	4.96791	44.8444	49.8123	2.2058E 04	7400
7600	1.0000	2.50000	22.6337	25.1337	4.96791	44.9769	49.9448	2.2654E 04	7600
7800	1.0000	2.50000	22.6986	25.1986	4.96791	45.1059	50.0738	2.3250E 04	7800
8000	1.0000	2.50000	22.7619	25.2619	4.96791	45.2317	50.1996	2.3846E 04	8000
8200	1.0000	2.50000	22.8237	25.3237	4.96791	45.3544	50.3223	2.4443E 04	8200
8400	1.0000	2.50000	22.8839	25.3839	4.96791	45.4741	50.4450	2.5039E 04	8400
8600	1.0000	2.50000	22.9427	25.4427	4.96791	45.5910	50.5589	2.5634E 04	8600
8800	1.0000	2.50000	23.0002	25.5002	4.96791	45.7052	50.6731	2.6231E 04	8800
9000	1.0000	2.50000	23.0564	25.5564	4.96791	45.8168	50.7848	2.6827E 04	9000
9200	1.0000	2.50000	23.1113	25.6113	4.96791	45.9260	50.8939	2.7423E 04	9200
9400	1.0000	2.50000	23.1651	25.6651	4.96791	46.0329	51.0008	2.8019E 04	9400
9600	1.0000	2.50000	23.2177	25.7177	4.96791	46.1375	51.1054	2.8615E 04	9600
9800	1.0000	2.50000	23.2693	25.7693	4.96791	46.2399	51.2078	2.9211E 04	9800
10000	1.0000	2.50000	23.3198	25.8198	4.96791	46.3403	51.3082	2.9807E 04	10000
10500	1.0000	2.50000	23.4418	25.9418	4.96791	46.5826	51.5506	3.1298E 04	10500
11000	1.0000	2.50000	23.5581	26.0581	4.96791	46.8138	51.7817	3.2788E 04	11000
11500	1.0000	2.50000	23.6692	26.1692	4.96791	47.0346	52.0025	3.4279E 04	11500
12000	1.0000	2.50000	23.7756	26.2756	4.96791	47.2460	52.2139	3.5769E 04	12000
12500	1.0000	2.50000	23.8776	26.3776	4.96791	47.4488	52.4167	3.7259E 04	12500
13000	1.0000	2.50000	23.9757	26.4757	4.96791	47.6437	52.6116	3.8750E 04	13000
13500	1.0000	2.50000	24.0700	26.5700	4.96791	47.8312	52.7991	4.0240E 04	13500
14000	1.0000	2.50000	24.1610	26.6610	4.96791	48.0118	52.9787	4.1730E 04	14000
14500	1.0000	2.50000	24.2487	26.7487	4.96791	48.1862	53.1541	4.3221E 04	14500
15000	1.0000	2.50000	24.3334	26.8334	4.96791	48.3546	53.3225	4.4711E 04	15000
15500	1.0000	2.50000	24.4154	26.9154	4.96791	48.5175	53.4854	4.6202E 04	15500
16000	1.0000	2.50000	24.4948	26.9948	4.96791	48.6752	53.6431	4.7692E 04	16000
16500	1.0000	2.50000	24.5717	27.0717	4.96791	48.8281	53.7950	4.9182E 04	16500
17000	1.0000	2.50000	24.6464	27.1464	4.96791	48.9764	53.9443	5.0673E 04	17000
17500	1.0000	2.50000	24.7188	27.2188	4.96791	49.1204	54.0883	5.2163E 04	17500
18000	1.0000	2.50000	24.7892	27.2892	4.96791	49.2603	54.2282	5.3653E 04	18000
18500	1.0000	2.50000	24.8577	27.3577	4.96791	49.3965	54.3644	5.5144E 04	18500
19000	1.0000	2.50000	24.9244	27.4244	4.96791	49.5289	54.4969	5.6634E 04	19000
19500	1.0000	2.50000	24.9894	27.4894	4.96791	49.6590	54.6259	5.8125E 04	19500



TABLE 32. IDEAL GAS FUNCTIONS FOR O<sub>2</sub> (ATOMIC WEIGHT 15.9955, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE 74 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	TEMP. (°K)
5000	2.0000	2.50000	22.4796	4.96791	44.6708	49.8387	1.4904E 04	2.4840E 04	2.5833E 04	2.6330E 05	5000		
5200	2.0000	2.50000	22.5777	4.96791	44.8656	49.8335	1.5500E 04	2.5833E 04	2.6330E 05	5200			
5400	2.0000	2.50000	22.6720	4.96791	45.0531	50.0210	1.6096E 04	2.6827E 04	2.7329E 05	5400			
5600	2.0000	2.50000	22.7630	4.96791	45.2338	50.2017	1.6692E 04	2.7820E 04	2.7820E 05	5600			
5800	2.0000	2.50000	22.8507	4.96791	45.4081	50.3760	1.7288E 04	2.8814E 04	2.8337E 05	5800			
6000	2.0000	2.50000	22.9354	4.96791	45.5765	50.5444	1.7884E 04	2.9807E 04	2.7344E 05	6000			
6200	2.0000	2.50000	23.0174	4.96791	45.7394	50.7073	1.8481E 04	3.0801E 04	2.8354E 05	6200			
6400	2.0000	2.50000	23.0968	4.96791	45.8971	50.8650	1.9077E 04	3.1795E 04	2.9374E 05	6400			
6600	2.0000	2.50000	23.1737	4.96791	46.0500	51.0179	1.9673E 04	3.2788E 04	3.0393E 05	6600			
6800	2.0000	2.50000	23.2483	4.96791	46.1983	51.1662	2.0269E 04	3.3782E 04	3.1415E 05	6800			
7000	2.0000	2.50000	23.3208	4.96791	46.3423	51.3102	2.0865E 04	3.4775E 04	3.2440E 05	7000			
7200	2.0000	2.50000	23.3912	4.96791	46.4823	51.4502	2.1461E 04	3.5769E 04	3.3467E 05	7200			
7400	2.0000	2.50000	23.4597	4.96791	46.6184	51.5863	2.2058E 04	3.6763E 04	3.4498E 05	7400			
7600	2.0000	2.50000	23.5264	4.96791	46.7509	51.7188	2.2654E 04	3.7756E 04	3.5531E 05	7600			
7800	2.0000	2.50000	23.5914	4.96791	46.8799	51.8478	2.3250E 04	3.8752E 04	3.6568E 05	7800			
8000	2.0000	2.50000	23.6546	4.96791	47.0037	51.9736	2.3846E 04	3.9743E 04	3.7608E 05	8000			
8200	2.0000	2.50000	23.7164	4.96791	47.1284	52.0963	2.4442E 04	4.0737E 04	3.8644E 05	8200			
8400	2.0000	2.50000	23.7766	4.96791	47.2481	52.2160	2.5038E 04	4.1730E 04	3.9680E 05	8400			
8600	2.0000	2.50000	23.8354	4.96791	47.3650	52.3329	2.5634E 04	4.2724E 04	4.0734E 05	8600			
8800	2.0000	2.50000	23.8929	4.96791	47.4792	52.4471	2.6231E 04	4.3718E 04	4.1782E 05	8800			
9000	2.0000	2.50000	23.9491	4.96791	47.5908	52.5587	2.6827E 04	4.4711E 04	4.2832E 05	9000			
9200	2.0000	2.50000	24.0040	4.96791	47.7000	52.6679	2.7423E 04	4.5705E 04	4.3881E 05	9200			
9400	2.0000	2.50000	24.0578	4.96791	47.8069	52.7748	2.8019E 04	4.6698E 04	4.4930E 05	9400			
9600	2.0000	2.50000	24.1104	4.96791	47.9114	52.8794	2.8615E 04	4.7692E 04	4.5979E 05	9600			
9800	2.0000	2.50000	24.1620	4.96791	48.0139	52.9818	2.9211E 04	4.8686E 04	4.7034E 05	9800			
10000	2.0000	2.50000	24.2125	4.96791	48.1142	53.0823	2.9807E 04	4.9679E 04	4.8114E 05	10000			
10500	2.0000	2.50000	24.3345	4.96791	48.3586	53.3245	3.1298E 04	5.2163E 04	5.0774E 05	10500			
11000	2.0000	2.50000	24.4508	4.96791	48.5877	53.5557	3.2788E 04	5.4647E 04	5.3447E 05	11000			
11500	2.0000	2.50000	24.5619	4.96791	48.8086	53.7765	3.4279E 04	5.7131E 04	5.6138E 05	11500			
12000	2.0000	2.50000	24.6683	4.96791	49.0200	53.9879	3.5769E 04	5.9615E 04	5.8824E 05	12000			
12500	2.0000	2.50000	24.7704	4.96791	49.2228	54.1907	3.7259E 04	6.2099E 04	6.1529E 05	12500			
13000	2.0000	2.50000	24.8684	4.96791	49.4177	54.3856	3.8750E 04	6.4583E 04	6.4243E 05	13000			
13500	2.0000	2.50000	24.9628	4.96791	49.6051	54.5731	4.0240E 04	6.7067E 04	6.6967E 05	13500			
14000	2.0000	2.50000	25.0537	4.96791	49.7858	54.7537	4.1730E 04	6.9551E 04	6.9700E 05	14000			
14500	2.0000	2.50000	25.1414	4.96791	49.9601	54.9281	4.3221E 04	7.2035E 04	7.2442E 05	14500			
15000	2.0000	2.50000	25.2262	4.96791	50.1284	55.0965	4.4711E 04	7.4519E 04	7.5193E 05	15000			
15500	2.0000	2.50000	25.3081	4.96791	50.2915	55.2594	4.6202E 04	7.7003E 04	7.7952E 05	15500			
16000	2.0000	2.50000	25.3875	4.96791	50.4492	55.4171	4.7692E 04	7.9487E 04	8.0719E 05	16000			
16500	2.0000	2.50000	25.4644	4.96791	50.6021	55.5700	4.9182E 04	8.1971E 04	8.3493E 05	16500			
17000	2.0000	2.50000	25.5391	4.96791	50.7504	55.7183	5.0673E 04	8.4455E 04	8.6276E 05	17000			
17500	2.0000	2.50000	25.6115	4.96791	50.8944	55.8623	5.2163E 04	8.6938E 04	8.9065E 05	17500			
18000	2.0000	2.50000	25.6820	4.96791	51.0343	56.0022	5.3654E 04	8.9422E 04	9.1864E 05	18000			
18500	2.0000	2.50000	25.7505	4.96791	51.1704	56.1384	5.5144E 04	9.1906E 04	9.4665E 05	18500			
19000	2.0000	2.50000	25.8171	4.96791	51.3029	56.2708	5.6634E 04	9.4390E 04	9.7478E 05	19000			
19500	2.0000	2.50000	25.8821	4.96791	51.4320	56.3999	5.8125E 04	9.6874E 04	1.0029E 06	19500			

TABLE 32 (CONT.) IDEAL GAS FUNCTIONS FOR U<sub>1</sub>

TEMP. (°K)	PARTIC. FUNCT.	$\frac{U^0 - U}{RT}$	$\frac{U^0 - U}{RT} - \frac{U^0 - U}{RT}$	$\frac{U^0 - U}{RT}$	$\frac{U^0 - U}{RT} - \frac{U^0 - U}{RT}$	$\frac{U^0 - U}{RT}$	$\frac{U^0 - U}{RT} - \frac{U^0 - U}{RT}$	$\frac{U^0 - U}{RT}$	$\frac{U^0 - U}{RT} - \frac{U^0 - U}{RT}$	TEMP. (°K)
20000	2.0000	2.50600	25.9454	28.4454	4.96791	51.5577	56.5257	5.96195	9.93505	20000
22000	2.0000	2.50000	26.1836	28.6836	4.96791	52.0312	56.9992	5.95295	9.94705	22000
24000	2.0000	2.50000	26.4012	28.9012	4.96791	52.4835	57.4515	5.94385	9.95815	24000
26000	2.0000	2.50000	26.6013	29.1013	4.96791	52.9161	57.8841	5.93465	9.96935	26000
28000	2.0000	2.50000	26.7866	29.2866	4.96791	53.3293	58.2973	5.92545	9.98055	28000
30000	2.0000	2.50000	26.9590	29.4590	4.96791	53.7221	58.6901	5.91625	9.99175	30000
32000	2.0000	2.50000	27.1204	29.6204	4.96791	54.0947	59.0627	5.90705	1.00295	32000
34000	2.0000	2.50000	27.2719	29.7719	4.96791	54.4478	59.4158	5.89785	1.01415	34000
36000	2.0000	2.50000	27.4148	29.9148	4.96791	54.7811	59.7491	5.88865	1.02535	36000
38000	2.0000	2.50000	27.5500	30.0500	4.96791	55.0956	60.0636	5.87945	1.03655	38000
40000	2.0000	2.50000	27.6782	30.1782	4.96791	55.3912	60.3492	5.87025	1.04775	40000
42000	2.0000	2.50000	27.8002	30.3002	4.96791	55.6679	60.6059	5.86105	1.05895	42000
44000	2.0000	2.50000	27.9165	30.4165	4.96791	55.9256	60.8436	5.85185	1.07015	44000
46000	2.0000	2.50000	28.0278	30.5278	4.96791	56.1644	61.0624	5.84265	1.08135	46000
48000	2.0000	2.50000	28.1340	30.6340	4.96791	56.3851	61.2631	5.83345	1.09255	48000
50000	2.0000	2.50000	28.2361	30.7361	4.96791	56.5879	61.4459	5.82425	1.10375	50000
60000	2.0000	2.50000	28.6919	31.1919	4.96791	57.0156	61.8756	5.80585	1.12535	60000
70000	2.0000	2.50000	29.0773	31.5773	4.96791	57.3811	62.2411	5.78745	1.14695	70000
80000	2.0000	2.50000	29.4111	31.9111	4.96791	57.6944	62.5544	5.76905	1.16855	80000
90000	2.0000	2.50000	29.7056	32.2056	4.96791	57.9569	62.8169	5.75065	1.19015	90000
100000	2.0000	2.50000	29.9690	32.4690	4.96791	58.1694	63.0294	5.73225	1.21175	100000
150000	2.0000	2.50000	30.9826	33.4826	4.96791	61.5676	66.4276	5.65385	1.29335	150000
200000	2.0000	2.50000	31.7018	34.2018	4.96791	62.9968	67.8568	5.63545	1.31495	200000
300000	2.0000	2.50000	32.7155	35.2155	4.96791	65.0111	69.8711	5.61705	1.33655	300000
400000	2.0000	2.50000	33.4347	35.9347	4.96791	66.6403	71.5003	5.60865	1.35815	400000
500000	2.0000	2.50002	33.9926	36.4926	4.96735	67.5688	72.4288	5.60025	1.36975	500000
600000	2.0000	2.50024	34.4484	36.9484	4.96839	68.4544	73.3144	5.59185	1.38135	600000
800000	2.0011	2.50598	35.1681	37.6681	4.97899	69.8848	74.7448	5.58345	1.39295	800000
1000000	2.0088	2.53892	35.7298	38.2298	5.00129	71.0010	75.8610	5.57505	1.40455	1000000
1500000	2.1535	2.91365	36.8130	39.3130	5.78991	73.1535	78.0135	5.56665	1.41615	1500000
2000000	2.6609	3.59459	37.7438	40.2438	7.14305	75.0032	80.1632	5.55825	1.42775	2000000
3000000	4.8951	4.25653	39.3670	41.8670	8.45842	78.2288	83.3888	5.54985	1.43935	3000000
4000000	8.0943	4.18532	40.5892	43.0892	8.31692	80.4574	85.6174	5.54145	1.45095	4000000
5000000	11.5415	3.98451	41.5018	44.0018	8.55943	82.4787	87.6387	5.53305	1.46255	5000000
6000000	14.8739	3.79748	42.2113	44.7113	8.75422	83.8808	89.0408	5.52465	1.47415	6000000
8000000	20.7345	3.51801	43.2627	45.7627	8.99086	85.9701	91.1301	5.51625	1.48575	8000000
10000000	25.4728	3.33161	44.0264	46.5264	8.62046	87.4876	92.6476	5.50785	1.49735	10000000

TABLE 33. IDEAL GAS FUNCTIONS FOR AR 76 (ATOMIC WEIGHT 39.9440,  $R = 1.98717$  CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 75 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{h^2 E}{RT}$	$\frac{h^2 E}{RT} - \frac{F^0 - E^0}{RT}$	$\frac{h^2 E}{RT} - \frac{F^0 - E^0}{RT} - \frac{F^0 - E^0}{RT}$	$\frac{h^2 E}{RT} - \frac{F^0 - E^0}{RT} - \frac{F^0 - E^0}{RT}$	$\frac{h^2 E}{RT} - \frac{F^0 - E^0}{RT} - \frac{F^0 - E^0}{RT}$	$\frac{h^2 E}{RT} - \frac{F^0 - E^0}{RT} - \frac{F^0 - E^0}{RT}$	$\frac{h^2 E}{RT} - \frac{F^0 - E^0}{RT} - \frac{F^0 - E^0}{RT}$	TEMP. (°K)
5000	2.0000	2.50000	23.8524	46.3524	4.96791	47.3966	52.3666	1.49046	5000
5200	2.0000	2.50000	23.9504	46.4504	4.96791	47.5935	52.5614	1.55006	5200
5400	2.0000	2.50000	24.0448	46.5448	4.96791	47.7810	52.7490	1.60946	5400
5600	2.0000	2.50000	24.1357	46.6357	4.96791	47.9617	52.9296	1.66826	5600
5800	2.0000	2.50000	24.2234	46.7234	4.96791	48.1360	53.1039	1.72686	5800
6000	2.0000	2.50000	24.3082	46.8082	4.96791	48.3044	53.2723	1.78486	6000
6200	2.0000	2.50000	24.3902	46.8902	4.96791	48.4673	53.4352	1.84216	6200
6400	2.0000	2.50000	24.4695	46.9695	4.96791	48.6250	53.5929	1.89876	6400
6600	2.0000	2.50000	24.5465	47.0465	4.96791	48.7779	53.7458	1.95476	6600
6800	2.0000	2.50000	24.6211	47.1211	4.96791	48.9262	53.8941	2.00996	6800
7000	2.0000	2.50000	24.6936	47.1936	4.96791	49.0702	54.0381	2.06436	7000
7200	2.0000	2.50000	24.7640	47.2640	4.96791	49.2112	54.1781	2.11786	7200
7400	2.0000	2.50000	24.8325	47.3325	4.96791	49.3483	54.3142	2.17046	7400
7600	2.0000	2.50000	24.8992	47.3992	4.96791	49.4788	54.4467	2.22216	7600
7800	2.0000	2.50000	24.9641	47.4641	4.96791	49.6078	54.5757	2.27296	7800
8000	2.0000	2.50000	25.0274	47.5274	4.96791	49.7336	54.7015	2.32286	8000
8200	2.0000	2.50000	25.0891	47.5891	4.96791	49.8563	54.8242	2.37186	8200
8400	2.0000	2.50000	25.1494	47.6494	4.96791	49.9760	54.9439	2.41996	8400
8600	2.0000	2.50000	25.2082	47.7082	4.96791	50.0929	55.0608	2.46716	8600
8800	2.0000	2.50000	25.2657	47.7657	4.96791	50.2071	55.1750	2.51346	8800
9000	2.0000	2.50000	25.3219	47.8219	4.96791	50.3187	55.2866	2.55886	9000
9200	2.0000	2.50000	25.3768	47.8768	4.96791	50.4279	55.3959	2.60336	9200
9400	2.0000	2.50000	25.4306	47.9306	4.96791	50.5348	55.5027	2.64696	9400
9600	2.0000	2.50000	25.4832	47.9832	4.96791	50.6393	55.6073	2.68966	9600
9800	2.0000	2.50000	25.5348	48.0348	4.96791	50.7418	55.7097	2.73146	9800
10000	2.0000	2.50000	25.5853	48.0853	4.96791	50.8421	55.8101	2.77236	10000
10500	2.0000	2.50000	25.7072	48.2072	4.96791	51.0845	56.0524	2.85186	10500
11000	2.0000	2.50000	25.8235	48.3235	4.96791	51.3156	56.2835	2.92986	11000
11500	2.0000	2.50000	25.9347	48.4347	4.96791	51.5345	56.5044	3.00636	11500
12000	2.0000	2.50000	26.0411	48.5411	4.96791	51.7479	56.7138	3.08146	12000
12500	2.0000	2.50000	26.1431	48.6431	4.96791	51.9507	56.9166	3.15516	12500
13000	2.0000	2.50001	26.2412	48.7412	4.96791	52.1455	57.1135	3.22746	13000
13500	2.0000	2.50001	26.3355	48.8355	4.96791	52.3330	57.3010	3.29836	13500
14000	2.0000	2.50002	26.4264	48.9264	4.96791	52.5137	57.4817	3.36786	14000
14500	2.0000	2.50003	26.5142	49.0142	4.96791	52.6880	57.6560	3.43596	14500
15000	2.0000	2.50003	26.5989	49.0989	4.96791	52.8565	57.8245	3.50266	15000
15500	2.0000	2.50004	26.6809	49.1810	4.96804	53.0194	57.9876	3.56796	15500
16000	2.0000	2.50011	26.7603	49.2604	4.96813	53.1771	58.1452	3.63186	16000
16500	2.0000	2.50018	26.8372	49.3374	4.96823	53.3300	58.2982	3.69436	16500
17000	2.0000	2.50022	26.9118	49.4121	4.96835	53.4783	58.4466	3.75546	17000
17500	2.0001	2.50030	26.9843	49.4846	4.96851	53.6223	58.5906	3.81516	17500
18000	2.0001	2.50040	27.0548	49.5552	4.96872	53.7623	58.7310	3.87346	18000
18500	2.0001	2.50053	27.1233	49.6238	4.96898	53.8986	58.8674	3.93036	18500
19000	2.0001	2.50070	27.1900	49.6907	4.96930	54.0309	59.0002	3.98586	19000
19500	2.0002	2.50089	27.2549	49.7558	4.96969	54.1600	59.1297	4.04006	19500



TABLE 33 (CONT.). IDEAL GAS FUNCTIONS FOR AIR 70

TEMP. (°F)	PARTIT. FUNCT.	$\frac{h^0 - h^0}{RT}$	$\frac{h^0 - h^0}{RT}$	$\frac{h^0 - h^0}{RT}$	$\frac{h^0 - h^0}{RT}$	$\frac{h^0 - h^0}{RT}$	$\frac{h^0 - h^0}{RT}$	$\frac{h^0 - h^0}{RT}$	$\frac{h^0 - h^0}{RT}$	$\frac{h^0 - h^0}{RT}$	TEMP. (°F)
20000	2.0002	2.50113	27.3102	29.0194	4.97016	54.2859	59.2540	5.94406	0.94406	1.04576	20000
22000	2.0006	2.50246	27.5567	30.0593	4.97308	54.7597	59.7328	6.56906	1.04416	1.20476	22000
24000	2.0012	2.50516	27.7765	30.2797	4.97817	55.1926	60.1708	7.17846	1.04426	1.32446	24000
26000	2.0023	2.50916	28.0752	30.5864	4.98612	55.5914	60.5775	7.79736	1.20446	1.44546	26000
28000	2.0041	2.51489	28.4614	30.9762	4.99751	55.9513	60.9588	8.42906	1.30936	1.56696	28000
30000	2.0067	2.52256	28.9351	30.9577	5.01276	56.3044	61.3193	9.07686	1.40346	1.68926	30000
32000	2.0102	2.53234	29.4962	31.0104	5.03217	56.6307	61.6628	9.74406	1.48136	1.81226	32000
34000	2.0148	2.54421	29.6521	31.1963	5.05571	56.9364	62.0922	1.04336	1.54906	1.93506	34000
36000	2.0207	2.55816	29.8779	31.3540	5.08348	57.2262	62.5097	1.11476	1.61016	2.04016	36000
38000	2.0279	2.57406	29.9366	31.5107	5.11508	57.5019	62.9169	1.18846	1.66536	2.14816	38000
40000	2.0365	2.59176	29.9691	31.6609	5.15025	57.7651	63.3134	1.26526	1.71526	2.25046	40000
42000	2.0466	2.61105	29.9790	31.8071	5.18859	58.0173	63.7009	1.34646	1.76046	2.34746	42000
44000	2.0582	2.63172	29.9719	31.9497	5.22967	58.2596	64.0793	1.43176	1.80176	2.43976	44000
46000	2.0713	2.65356	29.9534	32.0890	5.27303	58.4930	64.4493	1.51156	1.83906	2.52706	46000
48000	2.0858	2.67628	29.9248	32.2251	5.31822	58.7164	64.8166	1.59586	1.87336	2.60936	48000
50000	2.1019	2.69973	29.8858	32.3583	5.36480	58.9364	65.1812	1.68406	1.90466	2.68766	50000
52000	2.2233	2.82102	30.1615	32.7025	5.60583	59.9358	65.5416	2.17126	2.39186	3.17486	52000
54000	2.3357	2.93725	30.6092	33.3624	5.83480	60.8176	66.6544	2.69476	2.91476	3.69776	54000
56000	2.4932	3.04018	31.2043	34.0445	6.04135	61.6106	67.6320	3.25336	3.47336	4.25636	56000
58000	2.6769	3.12792	31.3376	34.6955	6.21569	62.3326	68.5483	3.84076	4.06076	4.84376	58000
60000	2.8648	3.20150	31.7011	34.9026	6.36190	62.9953	69.3572	4.45716	4.67716	5.46016	60000
62000	3.0993	3.25014	33.0484	34.6785	6.81625	65.6726	72.4088	5.10246	5.32246	6.10546	62000
64000	3.3193	3.28468	34.6528	37.5993	7.04744	67.6495	74.7159	5.77716	6.00016	6.78016	64000
66000	3.5101	3.31765	35.5101	39.1277	7.18886	70.5444	77.7532	6.48046	6.70346	7.48346	66000
68000	3.66975	3.34695	36.5459	40.1156	7.09368	72.6227	79.7164	7.21246	7.43546	8.21546	68000
70000	3.8150	3.36844	37.3335	40.8171	6.92258	74.1878	81.1104	7.97776	8.20076	8.98076	70000
72000	3.9437	3.38437	37.9687	41.3550	6.76519	75.6361	82.1793	8.77406	9.00016	9.77716	72000
74000	4.0513	3.40185	38.5153	42.1871	6.62110	77.3311	83.7732	9.60336	9.82946	10.60646	74000
76000	4.1462	3.41729	39.0228	42.7531	6.48444	79.3429	85.0974	10.46676	10.69286	11.46986	76000
78000	4.2299	3.43162	39.4959	43.1633	6.35762	81.1874	87.0444	11.36406	11.59016	12.36716	78000
80000	4.3041	3.44414	41.6887	44.5348	6.23975	82.8424	88.4981	12.29746	12.52356	13.29956	80000
82000	4.3695	3.45599	42.8195	45.5571	6.13006	85.0894	90.5294	13.26776	13.49386	14.26986	82000
84000	4.4268	3.46722	43.5985	46.2792	6.02696	86.6374	91.9644	14.27406	14.50016	15.27616	84000
86000	4.4762	3.47794	44.1926	46.8304	5.92949	88.0756	93.0756	15.31736	15.54346	16.31946	86000
88000	4.5184	3.48826	44.6728	47.2999	5.83692	89.0722	93.9827	16.39866	16.62476	17.39976	88000
90000	4.5537	3.49817	45.0526	47.6816	5.74916	90.2622	95.4133	17.51506	17.74116	18.51616	90000
92000	4.5826	3.50762	45.3462	47.9790	5.66590	91.4875	96.5225	18.66746	18.89356	19.66856	92000
94000	4.6065	3.51660	45.5986								

TABLE 34. IDEAL GAS FUNCTIONS FOR O<sub>2</sub>. IONIC WEIGHT 15.9950, R = 1.98717 CAL/MOLE I  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS 4, 5, 4.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{W^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT} - \ln \frac{W^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT} - \ln \frac{W^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT} - \ln \frac{W^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT} - \ln \frac{W^0 - E^0}{RT}$	TEMP. (°K)
5000	1.0000	21.7864	24.2464	4.46791	43.2933	48.2612	1.4904E 04	5000
5200	1.0000	21.8045	24.1945	4.46791	43.4881	48.5540	2.4840E 04	5200
5400	1.0000	21.8230	24.1426	4.46791	43.6830	48.8469	2.5933E 04	5400
5600	1.0000	21.8418	24.0908	4.46791	43.8780	49.1400	2.6827E 04	5600
5800	1.0000	21.8609	24.0391	4.46791	44.0731	49.4332	2.7620E 04	5800
6000	1.0000	21.8802	23.9875	4.46791	44.2683	49.7265	2.8314E 04	6000
6200	1.0000	21.9000	23.9360	4.46791	44.4636	50.0200	2.8907E 04	6200
6400	1.0000	21.9200	23.8846	4.46791	44.6590	50.3136	2.9400E 04	6400
6600	1.0000	21.9405	23.8333	4.46791	44.8545	50.6073	2.9893E 04	6600
6800	1.0000	21.9615	23.7821	4.46791	45.0501	50.9011	3.0386E 04	6800
7000	1.0000	21.9830	23.7310	4.46791	45.2458	51.1950	3.0879E 04	7000
7200	1.0000	22.0050	23.6800	4.46791	45.4416	51.4890	3.1372E 04	7200
7400	1.0000	22.0275	23.6291	4.46791	45.6375	51.7832	3.1865E 04	7400
7600	1.0000	22.0505	23.5783	4.46791	45.8335	52.0775	3.2358E 04	7600
7800	1.0000	22.0740	23.5276	4.46791	46.0296	52.3719	3.2851E 04	7800
8000	1.0000	22.1000	23.4770	4.46791	46.2258	52.6664	3.3344E 04	8000
8200	1.0000	22.1265	23.4265	4.46791	46.4221	52.9610	3.3837E 04	8200
8400	1.0000	22.1535	23.3761	4.46791	46.6185	53.2557	3.4330E 04	8400
8600	1.0000	22.1810	23.3258	4.46791	46.8150	53.5505	3.4823E 04	8600
8800	1.0000	22.2090	23.2756	4.46791	47.0116	53.8454	3.5316E 04	8800
9000	1.0000	22.2375	23.2255	4.46791	47.2083	54.1404	3.5809E 04	9000
9200	1.0000	22.2665	23.1755	4.46791	47.4051	54.4355	3.6302E 04	9200
9400	1.0000	22.2960	23.1256	4.46791	47.6020	54.7307	3.6795E 04	9400
9600	1.0000	22.3260	23.0758	4.46791	47.7990	55.0260	3.7288E 04	9600
9800	1.0000	22.3565	23.0261	4.46791	47.9961	55.3214	3.7781E 04	9800
10000	1.0000	22.3875	22.9765	4.46791	48.1933	55.6169	3.8274E 04	10000
10500	1.0000	22.4785	22.8777	4.46791	48.3906	55.9125	3.8767E 04	10500
11000	1.0000	22.5700	22.7791	4.46791	48.5880	56.2082	3.9260E 04	11000
11500	1.0000	22.6620	22.6807	4.46791	48.7855	56.5040	3.9753E 04	11500
12000	1.0000	22.7545	22.5824	4.46791	48.9831	56.8000	4.0246E 04	12000
12500	1.0000	22.8475	22.4842	4.46791	49.1808	57.0961	4.0739E 04	12500
13000	1.0000	22.9410	22.3861	4.46791	49.3786	57.3923	4.1232E 04	13000
13500	1.0000	23.0350	22.2881	4.46791	49.5765	57.6886	4.1725E 04	13500
14000	1.0000	23.1295	22.1902	4.46791	49.7745	57.9850	4.2218E 04	14000
14500	1.0000	23.2245	22.0924	4.46791	49.9726	58.2815	4.2711E 04	14500
15000	1.0000	23.3200	22.0000	4.46791	50.1708	58.5781	4.3204E 04	15000
15500	1.0000	23.4160	21.9077	4.46791	50.3691	58.8748	4.3697E 04	15500
16000	1.0000	23.5125	21.8155	4.46791	50.5675	59.1716	4.4190E 04	16000
16500	1.0000	23.6095	21.7234	4.46791	50.7660	59.4685	4.4683E 04	16500
17000	1.0000	23.7070	21.6314	4.46791	50.9646	59.7655	4.5176E 04	17000
17500	1.0000	23.8050	21.5395	4.46791	51.1633	60.0626	4.5669E 04	17500
18000	1.0000	23.9035	21.4477	4.46791	51.3621	60.3598	4.6162E 04	18000
18500	1.0000	24.0025	21.3560	4.46791	51.5610	60.6571	4.6655E 04	18500
19000	1.0000	24.1020	21.2644	4.46791	51.7600	60.9545	4.7148E 04	19000
19500	1.0000	24.2020	21.1729	4.46791	51.9591	61.2520	4.7641E 04	19500

TABLE 34 (CONT'D.). IDEAL GAS FUNCTIONS FOR O<sub>2</sub>

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	$\frac{h^2 - \epsilon^2}{RT}$	TEMP. (°K)
20000	1.0000	25.2522	27.7527	4.96791	50.1803	55.1402	5.9619E 04	9.9350E 04	1.0034E 04	1.0034E 04	20000
22000	1.0000	25.4905	27.9905	4.96791	50.4237	55.3831	6.5574E 04	1.0923E 05	1.1144E 04	1.1144E 04	22000
24000	1.0000	25.7080	28.2080	4.96791	51.0860	56.0539	7.1530E 04	1.1923E 05	1.2261E 04	1.2261E 04	24000
26000	1.0000	25.9081	28.4081	4.96791	51.4837	56.5516	7.7490E 04	1.2917E 05	1.3306E 04	1.3306E 04	26000
28000	1.0000	26.0934	28.5934	4.96791	51.8518	56.8197	8.3441E 04	1.3911E 05	1.4319E 04	1.4319E 04	28000
30000	1.0000	26.2658	28.7658	4.96791	52.1946	57.1625	8.9427E 04	1.4904E 05	1.5328E 04	1.5328E 04	30000
32000	1.0000	26.4272	28.9272	4.96791	52.5152	57.4831	9.5404E 04	1.5897E 05	1.6337E 04	1.6337E 04	32000
34000	1.0000	26.5787	29.0787	4.96791	52.8164	57.7843	1.0135E 05	1.6891E 05	1.7346E 04	1.7346E 04	34000
36000	1.0000	26.7216	29.2216	4.96791	53.1003	58.0682	1.0731E 05	1.7884E 05	1.8354E 04	1.8354E 04	36000
38000	1.0000	26.8568	29.3568	4.96791	53.3689	58.3368	1.1327E 05	1.8878E 05	1.9362E 04	1.9362E 04	38000
40000	1.0000	26.9850	29.4850	4.96791	53.6237	58.5917	1.1923E 05	1.9872E 05	2.0370E 04	2.0370E 04	40000
42000	1.0000	27.1070	29.6070	4.96791	53.8661	58.8340	1.2519E 05	2.0865E 05	2.1378E 04	2.1378E 04	42000
44000	1.0000	27.2233	29.7233	4.96791	54.0972	59.0652	1.3115E 05	2.1859E 05	2.2386E 04	2.2386E 04	44000
46000	1.0000	27.3345	29.8345	4.96791	54.3181	59.2860	1.3711E 05	2.2852E 05	2.3394E 04	2.3394E 04	46000
48000	1.0000	27.4408	29.9408	4.96791	54.5295	59.4974	1.4308E 05	2.3846E 05	2.4402E 04	2.4402E 04	48000
50000	1.0000	27.5429	30.0429	4.96791	54.7323	59.7002	1.4904E 05	2.4840E 05	2.5410E 04	2.5410E 04	50000
60000	1.0000	27.9987	30.4987	4.96791	55.6381	60.6060	1.7884E 05	2.9872E 05	3.3381E 04	3.3381E 04	60000
70000	1.0000	28.3841	30.8841	4.96791	56.4039	61.3718	2.0865E 05	3.4904E 05	4.1352E 04	4.1352E 04	70000
80000	1.0000	28.7119	31.2119	4.96791	57.0872	62.0352	2.3846E 05	3.9936E 05	4.9323E 04	4.9323E 04	80000
90000	1.0000	29.0124	31.5124	4.96791	57.6524	62.6203	2.6827E 05	4.4968E 05	5.7294E 04	5.7294E 04	90000
100000	1.0000	29.2758	31.7758	4.96791	58.1758	63.1437	2.9807E 05	4.9999E 05	6.5265E 04	6.5265E 04	100000
150000	1.0000	30.2894	32.7894	4.96791	60.1901	65.1580	4.4711E 05	7.4519E 05	9.0285E 04	9.0285E 04	150000
200000	1.0000	31.0086	33.5086	4.96791	61.6191	66.5872	5.9615E 05	9.9350E 05	1.2324E 05	1.2324E 05	200000
300000	1.0000	32.0223	34.5223	4.96791	63.6326	68.6015	8.9427E 05	1.4904E 06	1.9095E 05	1.9095E 05	300000
400000	1.0000	32.7415	35.2415	4.96791	65.0628	70.0307	1.1923E 06	1.9872E 06	2.4025E 05	2.4025E 05	400000
500000	1.0000	33.2994	35.7994	4.96791	66.1713	71.1393	1.4904E 06	2.4840E 06	3.3066E 05	3.3066E 05	500000
600000	1.0000	33.7552	36.2552	4.96791	67.0771	72.0450	1.7884E 06	2.9872E 06	4.0244E 05	4.0244E 05	600000
800000	1.0000	34.7744	37.2744	4.96791	68.5063	73.4742	2.3846E 06	3.9936E 06	5.4005E 05	5.4005E 05	800000
1000000	1.0000	35.1322	37.6322	4.96791	69.6148	74.5828	2.9807E 06	4.9999E 06	6.9615E 05	6.9615E 05	1000000
1500000	1.0000	36.0459	38.5459	4.96791	71.6292	76.5971	4.4711E 06	7.4519E 06	1.0744E 06	1.0744E 06	1500000
2000000	1.0000	36.7451	39.2451	4.96791	73.0583	78.0263	5.9615E 06	9.9350E 06	1.4612E 06	1.4612E 06	2000000
3000000	1.0000	37.7788	40.2788	4.96791	75.0727	80.0406	8.9427E 06	1.4904E 07	2.2522E 06	2.2522E 06	3000000
4000000	1.0000	38.4980	40.9980	4.96791	76.5018	81.4697	1.1923E 07	1.9872E 07	3.0401E 06	3.0401E 06	4000000
5000000	1.0000	39.0558	41.5558	4.96791	77.6104	82.5783	1.4904E 07	2.4840E 07	3.8003E 06	3.8003E 06	5000000
6000000	1.0000	39.5116	42.0116	4.96791	78.5161	83.6841	1.7884E 07	2.9872E 07	4.7110E 06	4.7110E 06	6000000
8000000	1.0000	40.2308	42.7308	4.96791	79.9453	84.9132	2.3846E 07	3.9936E 07	6.3956E 06	6.3956E 06	8000000
10000000	1.0000	40.7687	43.2687	4.96791	81.0539	86.0218	2.9807E 07	4.9999E 07	8.1054E 06	8.1054E 06	10000000

TABLE 35. IDEAL GAS FUNCTIONS FOR AR 0+ (ATOMIC WEIGHT 39.9440, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N 5+. SEE TABLE 76 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{W^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT} - \frac{E^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT} - \frac{E^0 - E^0}{RT} - \frac{E^0 - E^0}{RT}$	$\ln \frac{W^0 - E^0}{RT} - \frac{E^0 - E^0}{RT} - \frac{E^0 - E^0}{RT} - \frac{E^0 - E^0}{RT}$	TEMP. (°K)
3000	1.0000	23.1502	25.4592	4.96791	50.0002	1.5904E 04	2.3011E 05
3200	1.0000	23.2573	25.7573	4.96791	51.1840	1.5900E 04	2.3032E 05
3400	1.0000	23.3516	25.8516	4.96791	51.3715	1.5896E 04	2.3054E 05
3600	1.0000	23.4428	25.9428	4.96791	51.5522	1.5892E 04	2.3076E 05
3800	1.0000	23.5303	26.0303	4.96791	51.7265	1.5888E 04	2.3098E 05
4000	1.0000	23.6150	26.1150	4.96791	51.8949	1.5884E 04	2.3120E 05
4200	1.0000	23.6970	26.1970	4.96791	52.0578	1.5880E 04	2.3142E 05
4400	1.0000	23.7764	26.2764	4.96791	52.2155	1.5876E 04	2.3164E 05
4600	1.0000	23.8533	26.3533	4.96791	52.3684	1.5872E 04	2.3186E 05
4800	1.0000	23.9280	26.4280	4.96791	52.5167	1.5868E 04	2.3208E 05
5000	1.0000	24.0004	26.5004	4.96791	52.6607	1.5864E 04	2.3230E 05
5200	1.0000	24.0709	26.5709	4.96791	52.8007	1.5860E 04	2.3252E 05
5400	1.0000	24.1394	26.6394	4.96791	52.9368	1.5856E 04	2.3274E 05
5600	1.0000	24.2060	26.7060	4.96791	53.0693	1.5852E 04	2.3296E 05
5800	1.0000	24.2710	26.7710	4.96791	53.1993	1.5848E 04	2.3318E 05
6000	1.0000	24.3343	26.8343	4.96791	53.3261	1.5844E 04	2.3340E 05
6200	1.0000	24.3960	26.8960	4.96791	53.4498	1.5840E 04	2.3362E 05
6400	1.0000	24.4562	26.9562	4.96791	53.5705	1.5836E 04	2.3384E 05
6600	1.0000	24.5151	27.0151	4.96791	53.6884	1.5832E 04	2.3406E 05
6800	1.0000	24.5725	27.0725	4.96791	53.7976	1.5828E 04	2.3428E 05
7000	1.0000	24.6287	27.1287	4.96791	53.9002	1.5824E 04	2.3450E 05
7200	1.0000	24.6837	27.1837	4.96791	54.0018	1.5820E 04	2.3472E 05
7400	1.0000	24.7374	27.2374	4.96791	54.1023	1.5816E 04	2.3494E 05
7600	1.0000	24.7901	27.2901	4.96791	54.2019	1.5812E 04	2.3516E 05
7800	1.0000	24.8416	27.3416	4.96791	54.3004	1.5808E 04	2.3538E 05
8000	1.0000	24.8921	27.3921	4.96791	54.3977	1.5804E 04	2.3560E 05
8200	1.0000	24.9416	27.4416	4.96791	54.4938	1.5800E 04	2.3582E 05
8400	1.0000	24.9901	27.4901	4.96791	54.5887	1.5796E 04	2.3604E 05
8600	1.0000	25.0376	27.5376	4.96791	54.6823	1.5792E 04	2.3626E 05
8800	1.0000	25.0841	27.5841	4.96791	54.7746	1.5788E 04	2.3648E 05
9000	1.0000	25.1296	27.6296	4.96791	54.8657	1.5784E 04	2.3670E 05
9200	1.0000	25.1741	27.6741	4.96791	54.9555	1.5780E 04	2.3692E 05
9400	1.0000	25.2176	27.7176	4.96791	55.0440	1.5776E 04	2.3714E 05
9600	1.0000	25.2601	27.7601	4.96791	55.1313	1.5772E 04	2.3736E 05
9800	1.0000	25.3016	27.8016	4.96791	55.2174	1.5768E 04	2.3758E 05
10000	1.0000	25.3421	27.8421	4.96791	55.3023	1.5764E 04	2.3780E 05
10500	1.0000	25.4350	27.9350	4.96791	55.5412	1.5756E 04	2.3828E 05
11000	1.0000	25.5280	28.0280	4.96791	55.7761	1.5748E 04	2.3876E 05
11500	1.0000	25.6210	28.1210	4.96791	56.0079	1.5740E 04	2.3924E 05
12000	1.0000	25.7140	28.2140	4.96791	56.2364	1.5732E 04	2.3972E 05
12500	1.0000	25.8070	28.3070	4.96791	56.4617	1.5724E 04	2.4020E 05
13000	1.0000	25.8999	28.4000	4.96791	56.6840	1.5716E 04	2.4068E 05
13500	1.0000	25.9929	28.4929	4.96791	56.9039	1.5708E 04	2.4116E 05
14000	1.0000	26.0858	28.5858	4.96791	57.1212	1.5700E 04	2.4164E 05
14500	1.0000	26.1787	28.6787	4.96791	57.3364	1.5692E 04	2.4212E 05
15000	1.0000	26.2716	28.7716	4.96791	57.5495	1.5684E 04	2.4260E 05
15500	1.0000	26.3645	28.8645	4.96791	57.7605	1.5676E 04	2.4308E 05
16000	1.0000	26.4574	28.9574	4.96791	57.9695	1.5668E 04	2.4356E 05
16500	1.0000	26.5503	29.0503	4.96791	58.1765	1.5660E 04	2.4404E 05
17000	1.0000	26.6432	29.1432	4.96791	58.3815	1.5652E 04	2.4452E 05
17500	1.0000	26.7361	29.2361	4.96791	58.5845	1.5644E 04	2.4500E 05
18000	1.0000	26.8290	29.3290	4.96791	58.7855	1.5636E 04	2.4548E 05
18500	1.0000	26.9219	29.4219	4.96791	58.9845	1.5628E 04	2.4596E 05
19000	1.0000	27.0148	29.5148	4.96791	59.1815	1.5620E 04	2.4644E 05
19500	1.0000	27.1077	29.6077	4.96791	59.3765	1.5612E 04	2.4692E 05

TABLE 35 (CONT.). IDEAL GAS FUNCTIONS FOR AIR 8\*

TEMP. (°F)	PARTIT. FUNCT.	$\frac{h^0 - h^0}{RT}$	$-\frac{h^0 - h^0}{RT}$	$\ln \frac{h^0 - h^0}{RT}$	$h^0 - h^0$ - CAL/MOLE	$h^0 - h^0$ - CAL/MOLE	$h^0 - h^0$ - CAL/MOLE	$h^0 - h^0$ - CAL/MOLE	TEMP. (°F)
2000	1.0000	26.4250	29.1750	4.96791	52.9022	57.8762	5.9615E 04	9.9358E 04	2000
2200	1.0000	26.2633	29.3633	4.96791	53.3817	58.3496	6.5576E 04	1.0927E 05	2200
2400	1.0000	27.0808	29.5808	4.96791	53.8160	58.7819	7.1530E 04	1.1923E 05	2400
2600	1.0000	27.2809	29.7809	4.96791	54.2116	59.1796	7.7499E 04	1.2917E 05	2600
2800	1.0000	27.4662	29.9662	4.96791	54.5798	59.5477	8.3461E 04	1.3910E 05	2800
3000	1.0000	27.6366	30.1366	4.96791	54.9226	59.8905	8.9422E 04	1.4904E 05	3000
3200	1.0000	27.8000	30.3000	4.96791	55.2432	60.2111	9.5384E 04	1.5897E 05	3200
3400	1.0000	27.9516	30.4516	4.96791	55.5444	60.5129	1.0135E 05	1.6891E 05	3400
3600	1.0000	28.0944	30.5944	4.96791	55.8283	60.7962	1.0731E 05	1.7884E 05	3600
3800	1.0000	28.2296	30.7296	4.96791	56.0969	61.0648	1.1327E 05	1.8878E 05	3800
4000	1.0000	28.3578	30.8578	4.96791	56.3517	61.3196	1.1923E 05	1.9872E 05	4000
4200	1.0000	28.4798	30.9798	4.96791	56.5941	61.5620	1.2519E 05	2.0865E 05	4200
4400	1.0000	28.5961	31.0761	4.96791	56.8252	61.7931	1.3115E 05	2.1859E 05	4400
4600	1.0000	28.7073	31.2073	4.96791	57.0461	62.0140	1.3711E 05	2.2852E 05	4600
4800	1.0000	28.8137	31.3137	4.96791	57.2575	62.2254	1.4308E 05	2.3846E 05	4800
5000	1.0000	28.9157	31.4157	4.96791	57.4603	62.4282	1.4904E 05	2.4840E 05	5000
6000	1.0000	29.3715	31.8715	4.96791	58.3641	63.3340	1.7884E 05	2.9807E 05	6000
7000	1.0000	29.7549	32.2549	4.96791	59.1319	64.0998	2.0865E 05	3.4775E 05	7000
8000	1.0000	30.0907	32.5907	4.96791	59.7952	64.7831	2.3846E 05	3.9743E 05	8000
9000	1.0000	30.3892	32.8852	4.96791	60.3604	65.3683	2.6827E 05	4.4711E 05	9000
10000	1.0000	30.6426	33.1486	4.96791	60.8308	65.8717	2.9807E 05	4.9679E 05	10000
15000	1.0000	31.6622	34.1622	4.96792	62.9181	67.8860	4.4711E 05	7.4519E 05	15000
20000	1.0000	32.3815	34.8816	4.96828	64.3473	69.3156	5.9622E 05	9.9366E 05	20000
30000	1.0025	33.1976	35.6975	5.02229	66.3664	71.3889	9.1054E 05	1.5067E 06	30000
40000	1.0406	34.1562	36.6669	5.62913	67.8699	73.4991	1.4560E 06	2.2517E 06	40000
50000	1.2284	34.8779	38.6791	7.55374	69.3081	76.8618	2.7833E 06	3.7769E 06	50000
60000	1.7617	35.6829	40.7163	10.00229	70.9077	80.9100	4.8091E 06	6.0014E 06	60000
80000	4.3676	37.3168	43.3651	11.97916	74.1547	86.1330	7.9936E 06	9.5833E 06	80000
100000	9.4348	38.6494	44.8820	11.59031	76.8028	88.3931	9.60931E 06	1.1590E 07	100000
150000	30.6421	40.8611	45.8007	9.85558	81.1560	91.0136	1.1803E 07	1.4783E 07	150000
200000	57.1782	42.1841	46.5794	8.73633	83.8267	92.5611	1.3494E 07	1.7469E 07	200000
300000	108.2648	43.8361	47.6252	7.52942	87.1097	96.5391	1.6427E 07	2.2580E 07	300000
400000	149.6363	44.8790	48.3539	6.90315	89.1020	98.0871	1.9672E 07	2.7621E 07	400000
500000	181.9316	45.6323	48.9158	6.52494	90.7699	97.2036	2.2649E 07	3.2642E 07	500000
600000	207.3540	46.2189	49.3738	6.26931	91.8445	98.1130	2.5493E 07	3.7616E 07	600000
800000	244.3131	47.1021	50.0950	5.94749	93.5596	99.5471	3.1083E 07	4.7580E 07	800000
1000000	269.6555	47.7586	50.6538	5.75323	94.9043	100.6576	3.7661E 07	5.7532E 07	1000000

TABLE 36. IDEAL GAS FUNCTIONS FOR AR 9+ (ATOMIC WEIGHT 39.9430, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 77 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{U^0 - E^0}{RT}$	$-\frac{F^0 - E^0}{RT}$	$\frac{S^0}{R}$	$\ln \frac{U^0 - E^0}{RT} - \frac{U^0 - E^0}{RT}$	$-\ln \frac{F^0 - E^0}{RT} - \frac{F^0 - E^0}{RT}$	$\frac{S^0}{R}$	$\ln \frac{U^0 - E^0}{RT} - \frac{U^0 - E^0}{RT}$	$-\ln \frac{F^0 - E^0}{RT} - \frac{F^0 - E^0}{RT}$	TEMP. (°K)
20000	4.5458	2.65592	28.1391	30.7951	55.9171	61.1949	6.5812E 04	1.0554E 05	1.1183E 06	20000
22000	4.6142	2.65715	28.3233	31.0495	56.4203	61.7005	7.2647E 04	1.1614E 05	1.2412E 06	22000
24000	4.6777	2.65679	28.4923	31.2803	56.8797	62.1542	7.9215E 04	1.2671E 05	1.3515E 06	24000
26000	4.7365	2.65534	28.6361	31.4915	57.3022	62.5788	8.5525E 04	1.3719E 05	1.4699E 06	26000
28000	4.7910	2.65315	27.0329	31.6860	57.7225	62.9853	9.1982E 04	1.4762E 05	1.6154E 06	28000
30000	4.8414	2.65047	29.2158	31.8663	58.0567	63.3236	9.8393E 04	1.5801E 05	1.7417E 06	30000
32000	4.8882	2.64749	29.3868	32.0363	58.3964	63.6574	1.0476E 05	1.6833E 05	1.8648E 06	32000
34000	4.9316	2.64432	29.5472	32.1915	58.7151	63.9898	1.1110E 05	1.7844E 05	1.9943E 06	34000
36000	4.9720	2.64106	29.6982	32.3393	59.0153	64.2635	1.1740E 05	1.8894E 05	2.1246E 06	36000
38000	5.0097	2.63776	29.8409	32.4787	59.2989	64.5406	1.2367E 05	1.9918E 05	2.2553E 06	38000
40000	5.0448	2.63448	29.9762	32.6104	59.5676	64.8027	1.2992E 05	2.0941E 05	2.3827E 06	40000
42000	5.0776	2.63125	30.1046	32.7359	59.8229	65.0516	1.3615E 05	2.1961E 05	2.5126E 06	42000
44000	5.1085	2.62808	30.2270	32.8550	60.0800	65.2884	1.4234E 05	2.2979E 05	2.6428E 06	44000
46000	5.1371	2.62499	30.3437	32.9687	60.2980	65.5162	1.4854E 05	2.3992E 05	2.7737E 06	46000
48000	5.1642	2.62199	30.4554	33.0774	60.5198	65.7302	1.5471E 05	2.5010E 05	2.9050E 06	48000
50000	5.1896	2.61909	30.5623	33.1814	60.7324	65.9370	1.6087E 05	2.6023E 05	3.0366E 06	50000
60000	5.2972	2.60602	31.0387	33.6447	61.6790	66.8575	1.9149E 05	3.1072E 05	3.7807E 06	60000
70000	5.3800	2.59520	31.4395	34.0347	62.4756	67.6327	2.2189E 05	3.6100E 05	4.3733E 06	70000
80000	5.4556	2.58626	31.7855	34.3717	63.1630	68.3023	2.5217E 05	4.1115E 05	5.0530E 06	80000
90000	5.4987	2.57888	32.0897	34.6685	63.7675	68.8921	2.8237E 05	4.6122E 05	5.7391E 06	90000
100000	5.5428	2.57281	32.3410	34.9339	64.3067	69.4193	3.1254E 05	5.1124E 05	6.4307E 06	100000
150000	5.6881	2.55740	33.4006	35.9580	66.3725	71.4544	4.6422E 05	7.6230E 05	9.9559E 06	150000
200000	5.7823	2.55093	34.1362	36.6951	67.8343	72.9193	6.1957E 05	1.0170E 06	1.3547E 07	200000
300000	5.9445	2.54090	35.1779	37.7628	69.9043	75.0409	9.4484E 05	1.5410E 06	2.0771E 07	300000
400000	6.1516	2.67797	35.9310	38.6090	71.4008	76.7224	1.3338E 06	2.1284E 06	2.8540E 07	400000
500000	6.5944	3.02302	36.5590	39.5820	72.6487	78.6559	2.0100E 06	3.0034E 06	4.3324E 07	500000
600000	7.0928	3.73415	37.1682	40.9024	73.8594	81.2798	3.2599E 06	4.4522E 06	6.4314E 07	600000
800000	13.6786	5.20211	38.4430	43.6451	76.4323	86.7497	6.6802E 06	8.2780E 06	1.1646E 07	800000
1000000	26.5840	5.61764	39.6954	45.3031	78.8614	90.0247	9.1761E 06	1.1163E 07	1.6861E 07	1000000
1500000	86.9081	5.09046	41.8835	46.9740	83.2295	93.3450	1.2193E 07	1.5173E 07	2.2404E 08	1500000
2000000	158.9542	6.53823	43.2675	47.8057	85.9797	94.9379	1.6042E 07	1.8024E 07	2.7194E 08	2000000
3000000	336.8711	7.25843	44.9712	48.8897	89.3653	97.1121	2.3240E 07	2.3240E 07	3.6810E 08	3000000
4000000	478.7323	7.55947	46.0419	49.6013	91.6228	99.5861	2.9346E 07	2.9346E 07	4.6537E 08	4000000
5000000	592.0501	7.85194	46.8122	50.1641	93.0236	99.8844	3.5346E 07	3.5346E 07	5.6512E 08	5000000
6000000	842.5295	8.21717	47.4102	50.6224	94.3311	100.5950	4.2370E 07	4.2370E 07	6.6527E 08	6000000
8000000	815.8030	8.03605	48.3078	51.3438	95.9955	102.0287	5.2346E 07	5.2346E 07	7.6796E 08	8000000
10000000	908.2249	8.29271	48.9730	51.9027	97.3174	103.1392	6.3346E 07	6.3346E 07	9.7317E 08	10000000

TABLE 37. IDEAL GAS FUNCTIONS FOR AN 10+ (ATOMIC WEIGHT 39.9430, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N S<sub>1/2</sub>. SEE TABLE 78 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIAL FUNCT.	$\frac{W^0-E^0}{RT}$	$-\frac{F^0-E^0}{RT}$	$S^0/N$	$\ln W^0-E^0_{VT}$ -- CAL/MOLE N	$S^0$	$F^0-E^0$ -- CAL/MOLE	$W^0-E^0$ -- CAL/MOLE	$-(W^0-E^0)$	TEMP. (°K)
20000	6.3668	2.7667	28.4760	31.2307	5.47398	56.8666	62.0606	6.9734E 04	1.0940E 05	1.1317E 04
22000	6.5251	2.76060	28.7389	31.4995	5.48577	57.1089	62.5947	7.6969E 04	1.2049E 05	1.2564E 04
24000	6.6763	2.76610	29.0093	31.7754	5.49670	57.3867	63.0834	8.4229E 04	1.3192E 05	1.3821E 04
26000	6.8214	2.77133	29.2009	31.9723	5.50709	58.0271	63.5342	9.1510E 04	1.4310E 05	1.5007E 04
28000	6.9613	2.77630	29.4065	32.1928	5.51637	58.6355	63.9525	9.8835E 04	1.5440E 05	1.6362E 04
30000	7.0964	2.78099	29.5982	32.3792	5.52629	59.8165	64.3628	1.0617E 05	1.6579E 05	1.7645E 04
32000	7.2273	2.78536	29.7778	32.5632	5.53437	59.1734	64.7084	1.1353E 05	1.7712E 05	1.8924E 04
34000	7.3543	2.78915	29.9468	32.7362	5.54291	59.5092	65.0521	1.2090E 05	1.8844E 05	2.0232E 04
36000	7.4777	2.79295	30.1063	32.8993	5.55006	59.8263	65.3763	1.2824E 05	1.9980E 05	2.1537E 04
38000	7.5978	2.79613	30.2574	33.0536	5.55638	60.1265	65.6829	1.3563E 05	2.1114E 05	2.2840E 04
40000	7.7146	2.79890	30.4009	33.1998	5.56188	60.4117	65.9735	1.4299E 05	2.2240E 05	2.4165E 04
42000	7.8284	2.80125	30.5375	33.3388	5.56658	60.6831	66.2497	1.5033E 05	2.3340E 05	2.5487E 04
44000	7.9392	2.80320	30.6678	33.4711	5.57053	60.9422	66.5126	1.5764E 05	2.4510E 05	2.6815E 04
46000	8.0473	2.80477	30.7925	33.5973	5.57355	61.1899	66.7634	1.6497E 05	2.5630E 05	2.8147E 04
48000	8.1525	2.80599	30.9119	33.7179	5.57596	61.5271	67.0031	1.7226E 05	2.6765E 05	2.9485E 04
50000	8.2552	2.80686	31.0265	33.8354	5.57770	61.6548	67.2325	1.7953E 05	2.7880E 05	3.0827E 04
60000	8.7312	2.80706	31.5386	34.3654	5.57810	62.6720	68.2501	2.1546E 05	3.3400E 05	3.7603E 04
70000	9.1316	2.80240	31.9708	34.7732	5.56483	63.5312	69.1001	2.5072E 05	3.8902E 05	4.4472E 04
80000	9.5244	2.79514	32.3445	35.1397	5.55440	64.2739	69.8283	2.8538E 05	4.4435E 05	5.1619E 04
90000	9.8565	2.78687	32.6733	35.4602	5.53798	64.9272	70.4652	3.1957E 05	4.9842E 05	5.8434E 04
100000	10.1547	2.77866	32.9665	35.7451	5.52166	65.5098	71.0315	3.5345E 05	5.5217E 05	6.5519E 04
150000	11.3039	2.75389	34.0874	36.8412	5.47243	67.7372	73.2096	5.2279E 05	8.2084E 05	1.0141E 07
200000	12.1608	2.75784	34.9796	37.6375	5.48029	69.3116	76.7919	6.9862E 05	1.0941E 06	1.3843E 07
300000	13.5871	2.79219	36.0042	38.7964	5.54854	71.5463	77.0948	1.0644E 06	1.6644E 06	2.1644E 07
400000	14.8300	2.81400	36.8109	39.6249	5.59188	73.1494	78.7413	1.4419E 06	2.2340E 06	2.9240E 07
500000	15.9175	2.81805	37.4396	40.2576	5.59994	74.3986	79.985	1.8044E 06	2.8000E 06	3.7149E 07
600000	16.8594	2.81139	37.9529	40.7643	5.58669	75.4186	81.0053	2.1597E 06	3.3520E 06	4.5251E 07
700000	17.6784	2.78557	38.7583	41.5439	5.53538	77.0152	82.554	2.8384E 06	4.4283E 06	6.1615E 07
800000	18.3275	2.75718	39.3768	42.1340	5.47897	78.2483	83.7272	3.4918E 06	5.4790E 06	7.8240E 07
900000	19.2239	2.69979	40.4832	43.1830	5.36493	80.4447	85.1117	5.0646E 06	8.0474E 06	1.00000E 08
1000000	20.5638	2.66129	41.2542	43.9155	5.28843	81.9789	87.2674	6.6055E 06	1.0577E 07	1.6394E 08
1500000	23.5872	2.61548	42.3236	44.9391	5.19740	84.1040	89.3014	9.6307E 06	1.5592E 07	2.5231E 08
2000000	26.5686	2.58967	43.0722	45.6619	5.14611	86.5916	90.7377	1.2634E 07	2.0504E 07	3.4237E 08
3000000	28.0178	2.57323	43.6482	46.2216	5.11343	88.7362	91.4496	1.5431E 07	2.5547E 07	4.3348E 08
4000000	28.5271	2.56186	44.1163	46.6781	5.09083	87.6663	92.7572	1.8622E 07	3.0545E 07	5.2608E 08
5000000	29.7252	2.54718	44.8511	47.3983	5.06166	89.1265	94.1882	2.4596E 07	4.0493E 07	7.1301E 08
6000000	29.9703	2.53812	45.4184	47.9565	5.04367	90.2539	95.4976	3.0545E 07	5.0437E 07	9.0254E 08

TABLE 30. IDEAL GAS FUNCTIONS FOR AN 11+ IONIC WEIGHT 39.9420,  $R = 1.98717$  CAL/MOLE  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 79 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{W-E}{RT}$	$\frac{W-E}{RT}$	$\frac{W-E}{RT}$	$\frac{W-E}{RT}$	$\frac{W-E}{RT}$	$\frac{W-E}{RT}$	$\frac{W-E}{RT}$	$\frac{W-E}{RT}$	$\frac{W-E}{RT}$	TEMP. (°K)
20000	4.0044	2.90882	26.0123	30.5212	4.98543	59.6452	60.6506	5.9965E 04	9.9709E 04	1.1133E 04	20000
22000	4.0092	2.91620	26.2518	30.7680	5.00010	56.1410	61.1411	6.0285E 04	1.0000E 05	1.2351E 04	22000
24000	4.0144	2.92472	26.4711	30.9979	5.01701	56.3769	61.5979	7.2812E 04	1.0504E 05	1.3578E 04	24000
26000	4.0273	2.94056	26.6739	31.2165	5.04856	56.8798	62.0284	7.9594E 04	1.3124E 05	1.4815E 04	26000
28000	4.0419	2.95378	26.8628	31.4206	5.08272	57.3552	62.4379	8.6676E 04	1.4232E 05	1.6059E 04	28000
30000	4.0608	2.97811	26.9399	31.6181	5.12313	57.7072	62.8303	9.4079E 04	1.5360E 05	1.7312E 04	30000
32000	4.0804	2.99126	26.9701	31.8083	5.16914	58.0393	63.2084	1.0182E 05	1.6541E 05	1.8573E 04	32000
34000	4.1125	2.98282	26.9385	31.9923	5.21993	58.3541	63.5741	1.0991E 05	1.7748E 05	1.9840E 04	34000
36000	4.1456	2.96432	26.8564	32.1708	5.27458	58.6540	63.9284	1.1893E 05	1.8980E 05	2.1113E 04	36000
38000	4.1836	2.94328	26.7407	32.3440	5.33211	58.9407	64.2729	1.2711E 05	2.0262E 05	2.2397E 04	38000
40000	4.2263	2.91321	26.7991	32.5123	5.39160	59.2157	64.6073	1.3618E 05	2.1564E 05	2.3686E 04	40000
42000	4.2737	2.94367	26.9322	32.6759	5.45213	59.4803	64.9324	1.4553E 05	2.2899E 05	2.4982E 04	42000
44000	4.3254	2.97425	30.0406	32.8348	5.51290	59.7353	65.2482	1.5513E 05	2.4257E 05	2.6284E 04	44000
46000	4.3814	2.80459	30.1844	32.9881	5.57318	59.9817	65.5549	1.6496E 05	2.5637E 05	2.7592E 04	46000
48000	4.4414	2.83437	30.3045	33.1369	5.63236	60.2201	65.8525	1.7497E 05	2.7035E 05	2.8904E 04	48000
50000	4.5031	2.86333	30.4208	33.2842	5.68971	60.4512	66.1412	1.8514E 05	2.8450E 05	3.0224E 04	50000
60000	4.8703	2.99010	30.9546	33.9447	5.94181	61.5119	67.4537	2.3728E 05	3.5651E 05	3.6907E 04	60000
70000	5.2911	3.08124	31.4228	34.5041	6.12294	62.4424	68.5653	2.9950E 05	4.2861E 05	4.3710E 04	70000
80000	5.7417	3.13941	31.8384	34.9778	6.23852	63.2482	69.5067	3.4011E 05	4.9908E 05	5.2613E 04	80000
90000	6.2038	3.17196	32.2103	35.3822	6.30321	64.0071	70.3103	3.8844E 05	5.6729E 05	5.7606E 04	90000
100000	6.6647	3.18624	32.5453	35.7316	6.33158	64.6730	71.0045	4.3444E 05	6.3314E 05	6.4673E 04	100000
150000	8.7580	3.13865	33.8321	36.9708	6.23701	67.2300	73.4670	6.3748E 05	9.3594E 05	1.0092E 07	150000
200000	10.3974	3.05060	34.7229	37.7735	6.06266	69.0002	75.0822	8.1498E 05	1.2124E 06	1.3088E 07	200000
300000	12.4610	2.91425	35.9320	38.8462	5.79109	71.4028	77.1939	1.1412E 06	1.7373E 06	2.1421E 07	300000
400000	14.0606	2.82785	36.7376	39.5855	5.61940	73.0435	78.6629	1.4529E 06	2.2470E 06	2.9217E 07	400000
500000	15.0286	2.77033	37.3821	40.1524	5.50510	74.2843	79.7894	1.7590E 06	2.7529E 06	3.7142E 07	500000
600000	15.7281	2.72967	37.8834	40.6130	5.42430	75.2805	80.7048	2.0623E 06	3.2544E 06	4.5164E 07	600000
800000	16.6689	2.67630	38.6607	41.3369	5.31825	76.8251	82.1434	2.6649E 06	4.2544E 06	6.1440E 07	800000
1000000	17.2713	2.64295	39.2540	41.8970	5.25198	78.0042	83.2562	3.2649E 06	5.2520E 06	7.8004E 07	1000000
1500000	18.1218	2.59696	40.3157	42.9127	5.16062	80.1140	85.2747	4.7602E 06	7.7409E 06	1.2017E 08	1500000
2000000	18.5684	2.57335	41.0593	43.6326	5.11368	81.5916	86.7053	6.2530E 06	1.0227E 07	1.6310E 08	2000000
3000000	19.0300	2.54931	42.0975	44.6448	5.06590	83.4547	88.7204	9.2362E 06	1.5190E 07	2.5494E 08	3000000
4000000	19.2645	2.53714	42.8291	45.3642	5.04171	85.1084	90.1501	1.2210E 07	2.0167E 07	3.4043E 08	4000000
5000000	19.4103	2.52978	43.3944	45.9241	5.02709	86.2318	91.2589	1.5200E 07	2.5135E 07	4.3116E 08	5000000
6000000	19.5070	2.52446	43.8531	46.3800	5.01731	87.1674	92.1447	1.8181E 07	3.0104E 07	5.2280E 08	6000000
8000000	19.6287	2.51848	44.5304	47.0992	5.00504	88.5889	93.5940	2.6143E 07	4.0040E 07	7.0871E 08	8000000
10000000	19.7023	2.51496	45.1422	47.6571	4.99785	89.7949	94.7026	3.0105E 07	4.9976E 07	8.9705E 08	10000000



TABLE 19. IDEAL GAS FUNCTIONS FOR AM 12. (ATOMIC WEIGHT 39.9420, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N S. SEE TABLE 80 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{W_0 - E_0}{RT}$	$\ln \frac{W_0 - E_0}{RT}$	$\ln \frac{W_0 - E_0}{RT} - \ln \frac{W_0 - E_0}{RT}$	$\ln \frac{W_0 - E_0}{RT} - \ln \frac{W_0 - E_0}{RT}$	$\ln \frac{W_0 - E_0}{RT} - \ln \frac{W_0 - E_0}{RT}$	$\ln \frac{W_0 - E_0}{RT} - \ln \frac{W_0 - E_0}{RT}$	$\ln \frac{W_0 - E_0}{RT} - \ln \frac{W_0 - E_0}{RT}$	TEMP. (°K)			
20000	3.5607	3.28473	27.9005	31.1852	6.52729	55.4429	61.9701	9.0803E 04	1.3055E 05	1.1099E 05	1.1099E 04	20000
22000	3.5529	3.25253	28.2120	31.4645	6.44332	56.0619	62.5252	9.4473E 04	1.4219E 05	1.2334E 05	1.2334E 04	22000
24000	4.1085	3.22388	28.4938	31.7176	6.40639	56.6218	63.0262	1.0404E 05	1.5375E 05	1.3509E 05	1.3509E 04	24000
26000	4.3491	3.19266	28.7508	31.9499	6.36277	57.1326	63.4068	1.1346E 05	1.6526E 05	1.4854E 05	1.4854E 04	26000
28000	4.5764	3.17653	28.9870	32.1635	6.31228	57.6020	63.7153	1.2110E 05	1.7674E 05	1.6129E 05	1.6129E 04	28000
30000	4.7919	3.15704	29.2055	32.3625	6.27356	58.0341	64.3097	1.2859E 05	1.8821E 05	1.7411E 05	1.7411E 04	30000
32000	4.9946	3.13979	29.4037	32.5495	6.23929	58.4389	64.7952	1.3407E 05	1.9964E 05	1.8701E 05	1.8701E 04	32000
34000	5.1918	3.12461	29.5986	32.7230	6.20872	58.8172	65.2529	1.4353E 05	2.1110E 05	1.9998E 05	1.9998E 04	34000
36000	5.3783	3.11057	29.7787	32.8873	6.18122	59.1713	65.5329	1.5099E 05	2.2252E 05	2.1302E 05	2.1302E 04	36000
38000	5.5569	3.09801	29.9446	33.0426	6.15625	59.5048	65.8611	1.5843E 05	2.3394E 05	2.2612E 05	2.2612E 04	38000
40000	5.7283	3.08650	30.1032	33.1897	6.13338	59.8200	66.1334	1.6589E 05	2.4534E 05	2.3930E 05	2.3930E 04	40000
42000	5.8930	3.07586	30.2535	33.3294	6.11224	60.1187	66.2310	1.7329E 05	2.5677E 05	2.5239E 05	2.5239E 04	42000
44000	6.0516	3.06595	30.3964	33.4623	6.09255	60.4026	66.4992	1.8064E 05	2.6821E 05	2.6377E 05	2.6377E 04	44000
46000	6.2045	3.05665	30.5325	33.5891	6.07407	60.6730	66.7471	1.8800E 05	2.7964E 05	2.7910E 05	2.7910E 04	46000
48000	6.3521	3.04787	30.6624	33.7102	6.05662	60.9312	66.9878	1.9533E 05	2.9107E 05	2.9247E 05	2.9247E 04	48000
50000	6.4945	3.03953	30.7866	33.8261	6.04005	61.1781	67.2181	2.0264E 05	3.0200E 05	3.0509E 05	3.0509E 04	50000
60000	7.1419	3.00264	31.3374	34.3401	5.94674	62.2726	68.2394	2.3477E 05	3.5800E 05	3.7344E 05	3.7344E 04	60000
70000	7.6986	2.97113	31.7979	34.7690	5.90414	63.1876	69.0917	2.7419E 05	4.1329E 05	4.4231E 05	4.4231E 04	70000
80000	8.1523	2.94325	32.1927	35.1340	5.84873	63.9723	69.8210	3.0892E 05	4.6790E 05	5.1178E 05	5.1178E 04	80000
90000	8.6092	2.91820	32.5379	35.4561	5.79896	64.6583	70.4572	3.4304E 05	5.2191E 05	5.8192E 05	5.8192E 04	90000
100000	8.9863	2.89535	32.8442	35.7398	5.75394	65.2649	71.0208	3.7668E 05	5.7539E 05	6.5267E 05	6.5267E 04	100000
150000	10.3651	2.80914	34.0006	36.8097	5.58223	67.5648	73.1471	5.3926E 05	8.3733E 05	1.8195E 07	1.8195E 07	150000
200000	11.2354	2.75231	34.8004	37.5527	5.46930	69.1342	74.6235	6.9643E 05	1.0939E 06	2.3031E 07	2.3031E 07	200000
300000	12.2873	2.68356	35.9020	38.5855	5.33269	71.3431	76.6758	1.0037E 06	1.5990E 06	3.1403E 07	3.1403E 07	300000
400000	12.8557	2.64395	36.6481	39.3121	5.25397	72.8656	78.1195	1.3067E 06	2.1014E 06	4.2914E 07	4.2914E 07	400000
500000	13.2374	2.61831	37.2551	39.8735	5.20302	74.0321	79.2351	1.6079E 06	2.6013E 06	5.7014E 07	5.7014E 07	500000
600000	13.5034	2.60039	37.7308	40.3312	5.16741	74.9774	80.1448	1.9081E 06	3.1004E 06	7.4964E 07	7.4964E 07	600000
800000	13.8506	2.57702	38.4754	41.0525	5.12097	76.4570	81.5780	2.5070E 06	4.0968E 06	1.1464E 08	1.1464E 08	800000
1000000	14.0871	2.56247	39.0488	41.6113	5.09204	77.5964	82.6885	3.1049E 06	5.0920E 06	1.4594E 08	1.4594E 08	1000000
1500000	14.3658	2.54241	40.0835	42.6259	5.05219	79.6325	84.7047	4.5979E 06	7.5783E 06	2.1948E 08	2.1948E 08	1500000
2000000	14.5197	2.53210	40.8133	43.3454	5.01170	81.1028	86.1345	6.0891E 06	1.0043E 07	2.9221E 08	2.9221E 08	2000000
3000000	14.6766	2.52150	41.8377	44.3593	5.00083	83.1385	88.1494	9.0710E 06	1.5032E 07	4.4964E 08	4.4964E 08	3000000
4000000	14.7527	2.51627	42.5624	45.0726	5.00025	85.5787	90.5787	1.2053E 07	2.0821E 07	6.3831E 08	6.3831E 08	4000000
5000000	14.8044	2.51305	43.1238	45.8365	4.99385	88.4935	93.6073	1.5033E 07	2.6948E 07	8.2841E 08	8.2841E 08	5000000
6000000	14.8367	2.51090	43.5815	46.6024	4.98957	91.5931	96.6036	1.8014E 07	3.3937E 07	1.0942E 08	1.0942E 08	6000000
8000000	14.8772	2.50819	44.3034	48.8116	4.98419	98.0382	93.0224	2.3970E 07	4.9874E 07	1.4931E 08	1.4931E 08	8000000
10000000	14.9016	2.50656	44.8629	47.3695	4.98096	94.1500	94.1509	2.9930E 07	6.4910E 07	1.9150E 08	1.9150E 08	10000000

TABLE 40. IDEAL GAS FUNCTIONS FOR AN 13° (ATOMIC WEIGHT 39.9410, R = 1.98717 CAL/MOLE)  
BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N=54. SEE TABLE 81 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNC.	$\frac{V^2 - \bar{V}^2}{RT}$	$\ln \frac{V^2 - \bar{V}^2}{RT}$	$\ln \frac{V^2 - \bar{V}^2}{RT}$	$\ln \frac{V^2 - \bar{V}^2}{RT}$	$\ln \frac{V^2 - \bar{V}^2}{RT}$	$\ln \frac{V^2 - \bar{V}^2}{RT}$	$\ln \frac{V^2 - \bar{V}^2}{RT}$	$\ln \frac{V^2 - \bar{V}^2}{RT}$	$\ln \frac{V^2 - \bar{V}^2}{RT}$	TEMP. (°K)
20000	2.7834	2.95889	27.4444	30.6074	5.87980	54.9422	40.8220	7.7853E 04	1.1740E 05	1.0968E 04	20000
22000	2.9036	2.96301	27.9708	30.8938	5.88799	55.5031	41.3911	8.5818E 04	1.2211E 05	1.2211E 04	22000
24000	3.0213	2.96730	28.4824	31.1499	5.89459	56.0154	41.9000	1.4123E 04	1.2644E 05	1.3444E 04	24000
26000	3.1413	2.97574	28.9856	31.3812	5.90354	56.4860	42.3594	1.5271E 05	1.3071E 05	1.4686E 04	26000
28000	3.2643	2.98772	29.4772	31.5919	5.91571	56.9207	42.7783	1.6401E 05	1.3491E 05	1.5938E 04	28000
30000	3.3492	2.99824	29.9472	31.7855	5.93075	57.3242	43.1630	1.7516E 05	1.3904E 05	1.7197E 04	30000
32000	3.4441	2.99798	29.9265	31.9645	5.94839	57.7004	43.5188	1.8619E 05	1.4314E 05	1.8464E 04	32000
34000	3.5335	2.99746	29.9137	32.1312	5.96751	58.0525	43.8500	1.9712E 05	1.4724E 05	1.9730E 04	34000
36000	3.6178	2.99708	29.9023	32.2873	5.98804	58.3839	44.1602	2.0797E 05	1.5134E 05	2.1018E 04	36000
38000	3.6973	2.99705	29.9023	32.4342	5.99942	58.6951	44.4520	2.1876E 05	1.5544E 05	2.2304E 04	38000
40000	3.7725	2.99759	29.9055	32.5731	5.99813	58.9899	44.7280	2.2953E 05	1.5954E 05	2.3594E 04	40000
42000	3.8436	2.99806	29.9261	32.7058	5.99727	59.2695	44.9902	2.4027E 05	1.6364E 05	2.4889E 04	42000
44000	3.9113	2.99844	29.9599	32.8308	5.99604	59.5352	45.2403	2.5102E 05	1.6774E 05	2.6184E 04	44000
46000	3.9757	2.99873	30.0073	32.9513	5.99449	59.7885	45.4796	2.6179E 05	1.7184E 05	2.7479E 04	46000
48000	4.0372	2.99885	30.2091	33.0669	5.99303	60.0305	45.7095	2.7259E 05	1.7594E 05	2.8774E 04	48000
50000	4.0962	2.99876	30.3256	33.1784	5.99160	60.2621	45.9310	2.8344E 05	1.8004E 05	3.0069E 04	50000
60000	4.3625	2.99817	30.6444	33.4603	5.98727	61.2930	46.9403	3.0444E 05	1.9114E 05	3.2169E 04	60000
70000	4.6012	2.99727	31.2831	34.1361	5.98032	62.1647	47.8340	3.2544E 05	2.0224E 05	3.4269E 04	70000
80000	4.8113	2.99600	31.6457	34.5445	5.97242	62.9250	48.6496	3.4644E 05	2.1334E 05	3.6369E 04	80000
90000	5.0639	2.99471	32.0072	34.9269	5.96395	63.6036	49.4055	3.6744E 05	2.2444E 05	3.8469E 04	90000
100000	5.3050	2.99330	32.3171	35.2819	5.95500	64.2194	50.1110	3.8844E 05	2.3554E 05	4.0569E 04	100000
120000	6.4911	2.99187	33.5629	36.7486	5.94351	66.5940	52.0246	4.2944E 05	2.5654E 05	4.4669E 04	120000
140000	8.3222	2.99003	34.5003	37.8229	5.93081	68.5577	53.9303	4.7044E 05	2.7754E 05	4.8769E 04	140000
160000	11.6707	2.98769	35.8491	39.2738	5.91686	71.2778	55.8354	5.1144E 05	2.9854E 05	5.2869E 04	160000
180000	15.3623	2.98461	36.8461	40.2233	5.90102	73.2193	57.7403	5.5244E 05	3.1954E 05	5.6969E 04	180000
200000	18.5699	2.98096	37.5936	40.9115	5.88331	74.7047	59.6452	5.9344E 05	3.4054E 05	6.1069E 04	200000
220000	21.4330	2.97666	38.1928	41.4465	5.86557	75.8955	61.5501	6.3444E 05	3.6154E 05	6.5169E 04	220000
240000	26.1921	2.97187	39.1125	42.2513	5.84782	77.7231	63.4550	6.7544E 05	3.8254E 05	6.9269E 04	240000
260000	29.9000	2.96647	39.4028	42.8513	5.83007	79.0947	65.3599	7.1644E 05	4.0354E 05	7.3369E 04	260000
280000	34.2084	2.96032	41.0079	43.9082	5.81232	81.4894	67.2648	7.5744E 05	4.2454E 05	7.7469E 04	280000
300000	41.1086	2.95356	41.8294	44.6429	5.79457	83.1219	69.1695	7.9844E 05	4.4554E 05	8.1569E 04	300000
320000	44.6274	2.94628	42.9498	45.4678	5.77682	85.3484	71.0744	8.3944E 05	4.6654E 05	8.5669E 04	320000
340000	47.1536	2.93847	43.7241	46.3900	5.75907	87.2642	72.9793	8.8044E 05	4.8754E 05	8.9769E 04	340000
360000	48.7638	2.93012	44.3155	46.9506	5.74132	88.6422	74.8842	9.2144E 05	5.0854E 05	9.3869E 04	360000
380000	49.8790	2.92130	44.7939	47.4074	5.72357	89.0129	76.7891	9.6244E 05	5.2954E 05	9.7969E 04	380000
400000	51.3218	2.91197	45.5416	48.1276	5.70582	90.4908	78.6940	1.0034E 06	5.5054E 05	1.0206E 05	400000
420000	52.2145	2.90118	46.1147	48.6859	5.68807	91.4416	80.5989	1.0444E 06	5.7154E 05	1.0616E 05	420000

[illegible]

TABLE 42. IDEAL GAS FUNCTIONS FOR AR 15+ IONIC WEIGHT 39.9400,  $R = 1.98717$  CAL/MOLE) BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 6$ . SEE TABLE 83 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2 - \epsilon_0}{RT}$	$\ln \frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	$\ln \frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	$\ln \frac{h^2 - \epsilon_0}{RT}$	$\frac{h^2 - \epsilon_0}{RT}$	$\ln \frac{h^2 - \epsilon_0}{RT}$	TEMP. (°K)
20000	2.0000	2.5000	4.90791	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	20000
22000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	22000
24000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	24000
26000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	26000
28000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	28000
30000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	30000
32000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	32000
34000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	34000
36000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	36000
38000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	38000
40000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	40000
42000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	42000
44000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	44000
46000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	46000
48000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	48000
50000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	50000
52000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	52000
54000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	54000
56000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	56000
58000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	58000
60000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	60000
62000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	62000
64000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	64000
66000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	66000
68000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	68000
70000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	70000
72000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	72000
74000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	74000
76000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	76000
78000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	78000
80000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	80000
82000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	82000
84000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	84000
86000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	86000
88000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	88000
90000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	90000
92000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	92000
94000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	94000
96000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	96000
98000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	98000
100000	2.0000	2.5000	4.90792	54.2853	59.2533	5.9615E 04	9.9350E 04	1.0857E 04	1.0857E 04	100000

TABLE 43. IDEAL GAS FUNCTIONS FOR  $\mu = 10^{-6}$  (ATOMIC WEIGHT 39.9400,  $R = 1.98717$  CAL/MOLE) BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ . SEE TABLE 44 FOR LIST OF STATES USED.

TEMP. (°C)	PARTIC. FUMIT.	$\frac{W \cdot d^2}{T}$	$\frac{d^2}{T}$	$\frac{W}{T}$	$\frac{10^6 - 529T}{CAL \cdot MOLE \cdot ^\circ C}$	$\delta$	$\rho \cdot d^2$	$\frac{\rho \cdot d^2}{CAL \cdot MOLE \cdot ^\circ C}$	$\frac{10^6 - 529T}{CAL \cdot MOLE \cdot ^\circ C}$	$\frac{10^6 - 529T}{CAL \cdot MOLE \cdot ^\circ C}$	TEMP. (°C)
20000	1.0000	2.50000	26.6248	29.1248	4.96791	52.9079	5.96156	9.93566	9.93566	1.09422	20000
22000	1.0000	2.50000	26.8631	29.3631	4.96791	53.3814	6.25766	9.93566	9.93566	1.17446	22000
24000	1.0000	2.50000	27.0806	29.5806	4.96791	53.8137	7.75366	9.93566	9.93566	1.29156	24000
26000	1.0000	2.50000	27.2807	29.7807	4.96791	54.2113	7.74906	9.93566	9.93566	1.40956	26000
28000	1.0000	2.50000	27.4660	29.9660	4.96791	54.5795	8.34616	9.93566	9.93566	1.52822	28000
30000	1.0000	2.50000	27.6385	30.1385	4.96791	54.9223	8.94226	9.93566	9.93566	1.64772	30000
32000	1.0000	2.50000	27.7998	30.2998	4.96791	55.2429	9.53836	9.93566	9.93566	1.76706	32000
34000	1.0000	2.50000	27.9514	30.4514	4.96791	55.5461	10.13446	9.93566	9.93566	1.88636	34000
36000	1.0000	2.50000	28.0943	30.5943	4.96791	55.8280	10.73056	9.93566	9.93566	2.00566	36000
38000	1.0000	2.50000	28.2295	30.7295	4.96791	56.0956	1.13276	9.93566	9.93566	2.12496	38000
40000	1.0000	2.50000	28.3577	30.8577	4.96791	56.3516	1.19236	9.93566	9.93566	2.25416	40000
42000	1.0000	2.50000	28.4790	30.9797	4.96791	56.5938	1.25196	9.93566	9.93566	2.38336	42000
44000	1.0000	2.50000	28.5946	31.0946	4.96791	56.8249	1.31156	9.93566	9.93566	2.51256	44000
46000	1.0000	2.50000	28.7071	31.2071	4.96791	57.0456	1.37116	9.93566	9.93566	2.64176	46000
48000	1.0000	2.50000	28.8135	31.3135	4.96791	57.2557	1.43086	9.93566	9.93566	2.77096	48000
50000	1.0000	2.50000	28.9156	31.4156	4.96791	57.4560	1.49046	9.93566	9.93566	2.90016	50000
60000	1.0000	2.50000	29.1714	31.6714	4.96791	58.3658	2.09076	9.93566	9.93566	3.50136	60000
70000	1.0000	2.50000	29.7267	32.2267	4.96791	59.1316	2.69106	9.93566	9.93566	4.10256	70000
80000	1.0000	2.50000	30.0066	32.5066	4.96791	59.7949	3.29136	9.93566	9.93566	4.70376	80000
90000	1.0000	2.50000	30.3850	32.8850	4.96791	60.3801	3.89166	9.93566	9.93566	5.30496	90000
100000	1.0000	2.50000	30.6484	33.1484	4.96791	60.9035	4.49196	9.93566	9.93566	5.90616	100000
150000	1.0000	2.50000	31.6421	34.1421	4.96791	62.9178	6.09226	9.93566	9.93566	7.50646	150000
200000	1.0000	2.50000	32.3813	34.8813	4.96791	64.3470	7.69256	9.93566	9.93566	9.10676	200000
300000	1.0000	2.50000	33.3950	35.8950	4.96791	66.3613	10.29286	9.93566	9.93566	12.70706	300000
400000	1.0000	2.50000	34.1162	36.6162	4.96791	67.7905	12.89316	9.93566	9.93566	15.30736	400000
500000	1.0000	2.50000	34.6720	37.1720	4.96791	68.9990	15.49346	9.93566	9.93566	17.90766	500000
600000	1.0000	2.50000	35.1178	37.6278	4.96791	69.9048	18.09376	9.93566	9.93566	20.50796	600000
800000	1.0000	2.50000	36.3470	38.3470	4.96791	71.2360	22.69406	9.93566	9.93566	25.10826	800000
1000000	1.0000	2.50000	36.8484	38.8484	4.96791	72.3425	23.106	9.93566	9.93566	25.6096	1000000
1500000	1.0000	2.50000	37.8186	39.9186	4.96791	74.3568	27.3248	9.93566	9.93566	29.8284	1500000
2000000	1.0000	2.50000	38.1378	40.6378	4.96793	75.7660	28.9156	9.93566	9.93566	31.4176	2000000
3000000	1.0000	2.50255	39.1516	41.6542	4.97298	77.8007	30.9596	9.93566	9.93566	33.4616	3000000
4000000	1.0006	2.54844	39.8755	42.4219	5.00020	79.2391	32.9993	9.93566	9.93566	35.5016	4000000
5000000	1.0339	2.75902	40.6618	43.2159	5.04065	80.4044	34.9390	9.93566	9.93566	37.5416	5000000
6000000	1.1269	3.24730	41.0037	44.2510	6.02393	81.4812	36.8788	9.93566	9.93566	39.5816	6000000
8000000	1.6753	4.53645	42.1195	46.0599	9.01447	83.6983	38.8186	9.93566	9.93566	41.5214	8000000
10000000	2.4826	5.15134	43.2131	48.3444	10.23656	85.8715	40.7584	9.93566	9.93566	43.4612	10000000

TABLE 44. IDEAL GAS FUNCTIONS FOR AR 17. (ATOMIC WEIGHT 39.9390, R = 1.90717 CAL/MOLE)  
 BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS N ≤ 4. SEE TABLE B5 FOR LIST OF STATES USED.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT} - \frac{h^2 - \epsilon}{RT}$	$\frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT} - \frac{h^2 - \epsilon}{RT}$	$\ln \frac{h^2 - \epsilon}{RT}$	TEMP. (°K)
20000	2.0000	27.3179	29.6179	4.96791	54.2833	59.2532	5.96156	9.93586	20000
22000	2.0000	27.5562	30.0562	4.96791	54.7568	59.7267	4.95762	1.09292	22000
24000	2.0000	27.7737	30.2737	4.96791	55.1910	60.1509	1.19236	1.32462	24000
26000	2.0000	27.9739	30.4739	4.96791	55.5807	60.5564	7.74996	1.29176	26000
28000	2.0000	28.1591	30.6591	4.96791	55.9568	60.9247	6.34416	1.39106	28000
30000	2.0000	28.3316	30.8316	4.96791	56.2996	61.2675	8.94226	1.49046	30000
32000	2.0000	28.4930	30.9930	4.96791	56.6202	61.5881	1.58846	1.58846	32000
34000	2.0000	28.6445	31.1445	4.96791	56.9214	61.8893	1.01356	1.68916	34000
36000	2.0000	28.7874	31.2874	4.96791	57.2033	62.1733	1.07316	1.78846	36000
38000	2.0000	28.9226	31.4226	4.96791	57.4739	62.4419	1.13276	1.88786	38000
40000	2.0000	29.0508	31.5508	4.96791	57.7208	62.6967	1.19236	1.98726	40000
42000	2.0000	29.1728	31.6728	4.96791	57.9711	62.9391	1.25196	2.08666	42000
44000	2.0000	29.2891	31.7891	4.96791	58.2033	63.1702	1.31156	2.18596	44000
46000	2.0000	29.4002	31.9002	4.96791	58.4231	63.3910	1.37116	2.28536	46000
48000	2.0000	29.5066	32.0066	4.96791	58.6345	63.6024	1.43076	2.38476	48000
50000	2.0000	29.6087	32.1087	4.96791	58.8373	63.8052	1.49046	2.48406	50000
60000	2.0000	30.0645	32.5645	4.96791	59.7431	64.7110	1.78046	2.78046	60000
70000	2.0000	30.4498	32.9498	4.96791	60.5059	65.4768	2.08046	3.08046	70000
80000	2.0000	30.7837	33.2837	4.96791	61.1723	66.1402	2.38046	3.38046	80000
90000	2.0000	31.0781	33.5781	4.96791	61.7514	66.7253	2.68046	3.68046	90000
100000	2.0000	31.3415	33.8415	4.96791	62.2808	67.2487	2.98046	3.98046	100000
120000	2.0000	32.3552	34.8552	4.96791	64.2951	69.2630	4.47116	5.47116	120000
140000	2.0000	33.6744	36.1744	4.96791	65.7253	70.6932	5.96156	6.96156	140000
160000	2.0000	34.8081	37.3081	4.96791	67.3364	72.3065	8.94226	9.94226	160000
180000	2.0000	34.8673	37.3673	4.96791	69.1678	74.1397	1.19236	1.19236	180000
200000	2.0000	35.3451	37.8451	4.96791	70.2764	75.2483	1.49046	1.49046	200000
220000	2.0000	35.8299	38.3299	4.96791	71.1821	76.1540	1.78046	1.78046	220000
240000	2.0000	36.5481	39.0481	4.96791	72.6113	77.5792	2.38046	2.38046	240000
260000	2.0000	37.0980	39.5980	4.96791	73.7199	78.6878	2.98046	2.98046	260000
280000	2.0000	38.1117	40.6117	4.96791	75.7342	80.7021	4.47116	4.47116	280000
300000	2.0000	38.8389	41.3389	4.96791	77.1634	82.1313	5.96156	5.96156	300000
320000	2.0000	39.6445	42.1445	4.96791	79.1777	84.1460	8.94226	8.94226	320000
340000	2.0000	40.5442	43.0442	4.96791	80.6078	85.5952	1.19236	1.19236	340000
360000	2.0000	41.2544	43.7544	4.96791	81.7230	86.7099	1.32796	1.32796	360000
380000	2.0000	41.5934	44.0934	4.96791	82.6536	87.6500	1.92446	1.92446	380000
400000	2.0000	42.3929	44.8929	4.96791	84.2417	89.2387	3.19236	3.19236	400000
420000	2.0000	43.1228	45.6228	4.96791	85.6952	90.6922	5.07416	5.07416	420000
440000	2.0000	43.5534	46.0534	4.96791	86.8763	91.8733	7.06136	7.06136	440000
460000	2.0000	43.8842	46.3842	4.96791	87.8907	92.8877	9.14856	9.14856	460000
480000	2.0000	44.1228	46.6228	4.96791	88.7577	93.7547	11.33676	11.33676	480000
500000	2.0000	44.2734	46.7734	4.96791	89.4907	94.4877	13.62506	13.62506	500000
520000	2.0000	44.3442	46.8442	4.96791	90.1117	95.1087	16.01336	16.01336	520000
540000	2.0000	44.3342	46.8342	4.96791	90.6227	95.6197	18.50166	18.50166	540000
560000	2.0000	44.2442	46.7442	4.96791	91.0237	96.0207	21.08996	21.08996	560000
580000	2.0000	44.0742	46.5742	4.96791	91.3147	96.3117	23.77826	23.77826	580000
600000	2.0000	43.8242	46.3242	4.96791	91.5057	96.5027	26.56656	26.56656	600000
620000	2.0000	43.4942	45.9942	4.96791	91.5967	96.5937	29.45486	29.45486	620000
640000	2.0000	43.0842	45.5842	4.96791	91.5877	96.5847	32.44316	32.44316	640000
660000	2.0000	42.5942	45.0942	4.96791	91.4787	96.4757	35.53146	35.53146	660000
680000	2.0000	42.0242	44.5242	4.96791	91.2697	96.2667	38.71976	38.71976	680000
700000	2.0000	41.3742	43.8742	4.96791	90.9607	95.9577	42.00806	42.00806	700000
720000	2.0000	40.6442	43.1442	4.96791	90.5517	95.5487	45.39636	45.39636	720000
740000	2.0000	39.8342	42.3342	4.96791	90.0427	95.0397	48.88466	48.88466	740000
760000	2.0000	38.9442	41.4442	4.96791	89.4337	94.4307	52.47296	52.47296	760000
780000	2.0000	37.9742	40.4742	4.96791	88.7247	93.7217	56.16126	56.16126	780000
800000	2.0000	36.9242	39.4242	4.96791	87.9157	92.9127	59.94956	59.94956	800000
820000	2.0000	35.7942	38.2942	4.96791	86.9067	91.9037	63.83786	63.83786	820000
840000	2.0000	34.5842	37.0842	4.96791	85.6977	90.6947	67.82616	67.82616	840000
860000	2.0000	33.2942	35.7942	4.96791	84.2887	89.2857	71.91446	71.91446	860000
880000	2.0000	31.9242	34.4242	4.96791	82.6797	87.6767	76.10276	76.10276	880000
900000	2.0000	30.4742	32.9742	4.96791	80.9707	85.9677	80.39106	80.39106	900000
920000	2.0000	28.9442	31.4442	4.96791	79.1617	84.1587	84.77936	84.77936	920000
940000	2.0000	27.3342	29.8342	4.96791	77.1527	82.1497	89.26766	89.26766	940000
960000	2.0000	25.6442	28.1442	4.96791	74.9437	79.9407	93.85596	93.85596	960000
980000	2.0000	23.8742	26.3742	4.96791	72.5347	77.5317	98.54426	98.54426	980000
1000000	2.0000	22.0242	24.5242	4.96791	69.9257	74.9227	103.33256	103.33256	1000000

TABLE 49. IDEAL GAS FUNCTIONS FOR AR 10+ (ATOMIC WEIGHT 39.9505,  $R = 1.90717$  CAL/MOLE)

BASED ON ELECTRONIC STATES WITH PRINCIPAL QUANTUM NUMBERS  $n \leq 4$ .

TEMP. (°K)	PARTIT. FUNCT.	$\frac{U^0 - U}{RT}$	$\ln \frac{U^0 - U}{RT}$	$\ln \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT}$	$\ln \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT}$	$\ln \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT}$	$\ln \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT}$	$\ln \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT} - \frac{U^0 - U}{RT}$						
20000	1.0000	2.50000	26.6248	29.1248	4.96791	52.9079	57.0750	5.96135	9.93508	04	1.00000	00	20000	
22000	1.0000	2.50000	26.8631	29.3631	4.96791	53.2463	58.3403	6.05748	1.00292	05	1.17445	06	22000	
24000	1.0000	2.50000	27.0886	29.5886	4.96791	53.5813	59.7115	7.15308	04	1.00292	05	1.20185	06	24000
26000	1.0000	2.50000	27.2807	29.7807	4.96791	54.2113	59.1792	7.74098	04	1.20185	05	1.40945	06	26000
28000	1.0000	2.50000	27.4460	29.9460	4.96791	54.5794	59.5475	8.34616	04	1.39108	05	1.52076	06	28000
30000	1.0000	2.50000	27.6395	30.1395	4.96791	54.9222	59.8901	8.96228	04	1.40945	05	1.64571	06	30000
32000	1.0000	2.50000	27.7998	30.2998	4.96791	55.2528	60.2107	9.59845	04	1.50978	05	1.76702	06	32000
34000	1.0000	2.50000	27.9314	30.4314	4.96791	55.5440	60.5119	1.01335	05	1.60915	05	1.88958	06	34000
36000	1.0000	2.50000	28.0493	30.5493	4.96791	55.8279	60.7999	1.07315	05	1.70842	05	2.00902	06	36000
38000	1.0000	2.50000	28.2294	30.7294	4.96791	56.0965	61.0645	1.13276	05	1.80768	05	2.13176	06	38000
40000	1.0000	2.50000	28.3577	30.8577	4.96791	56.3514	61.3193	1.19235	05	1.90728	05	2.25415	06	40000
42000	1.0000	2.50000	28.4796	30.9796	4.96791	56.5937	61.5617	1.25195	05	2.00695	05	2.37645	06	42000
44000	1.0000	2.50000	28.5959	31.0959	4.96791	56.8249	61.7928	1.31185	05	2.10595	05	2.50025	06	44000
46000	1.0000	2.50000	28.7071	31.2071	4.96791	57.0457	62.0136	1.37115	05	2.20525	05	2.62345	06	46000
48000	1.0000	2.50000	28.8135	31.3135	4.96791	57.2571	62.2250	1.43005	05	2.30445	05	2.74625	06	48000
50000	1.0000	2.50000	28.9155	31.4155	4.96791	57.4599	62.4278	1.48945	05	2.40405	05	2.87205	06	50000
60000	1.0000	2.50000	29.3713	31.8713	4.96791	58.3657	63.3336	1.70845	05	2.63075	05	3.26195	06	60000
70000	1.0000	2.50000	29.7567	32.2567	4.96791	59.1315	64.0994	2.00435	05	3.47795	05	4.13925	06	70000
80000	1.0000	2.50000	30.0895	32.5895	4.96791	59.7949	64.7628	2.30445	05	3.97435	05	4.78345	06	80000
90000	1.0000	2.50000	30.3895	32.8895	4.96791	60.3800	65.3479	2.60275	05	4.47115	05	5.43425	06	90000
100000	1.0000	2.50000	30.6484	33.1484	4.96791	60.9034	65.8713	2.90075	05	4.96795	05	6.09095	06	100000
150000	1.0000	2.50000	31.8621	34.1421	4.96791	62.9177	67.8856	4.47115	05	7.45195	05	9.43775	06	150000
200000	1.0000	2.50000	32.3813	34.8813	4.96791	64.3469	69.3148	5.96135	05	9.93508	05	1.20095	07	200000
300000	1.0000	2.50000	33.3949	35.8949	4.96791	66.3612	71.3291	8.96228	05	1.40945	06	1.99078	07	300000
400000	1.0000	2.50000	34.1161	36.6161	4.96791	67.7904	72.7593	1.10235	06	1.90728	06	2.71168	07	400000
500000	1.0000	2.50000	34.6720	37.1720	4.96791	68.8990	73.8649	1.40945	06	2.40405	06	3.44445	07	500000
600000	1.0000	2.50000	35.1272	37.6272	4.96791	69.8047	74.7726	1.70845	06	2.90075	06	4.18035	07	600000
800000	1.0000	2.50000	35.8570	38.3570	4.96791	71.2339	76.2018	2.30445	06	3.97435	06	5.69075	07	800000
1000000	1.0000	2.50000	36.4049	38.9049	4.96791	72.3425	77.3104	2.90075	06	4.96795	06	7.23435	07	1000000
1500000	1.0000	2.50000	37.4185	39.9185	4.96791	74.3568	79.3257	4.47115	06	7.45195	06	1.11545	08	1500000
2000000	1.0000	2.50000	38.1377	40.6377	4.96791	75.7860	80.7559	5.96135	06	9.93508	06	1.51575	08	2000000
3000000	1.0000	2.50000	39.1514	41.6514	4.96791	77.8003	82.7682	8.96228	06	1.40945	07	2.33445	08	3000000
4000000	1.0000	2.50000	39.8706	42.3706	4.96791	79.2294	84.1974	1.19235	07	1.90728	07	3.16525	08	4000000
5000000	1.0000	2.50000	40.4284	42.9284	4.96791	80.3360	85.3059	1.40945	07	2.40405	07	4.01095	08	5000000
6000000	1.0000	2.50000	40.8842	43.3842	4.96791	81.2538	86.2117	1.70845	07	2.90075	07	4.87645	08	6000000
8000000	1.0000	2.50000	41.6035	44.1035	4.96791	82.6729	87.6409	2.30445	07	3.97435	07	6.41305	08	8000000
10000000	1.0000	2.50000	42.1613	44.6613	4.96791	83.7815	88.7494	2.90075	07	4.96795	07	8.37825	08	10000000

TABLE 3. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O-

STATE	LEVEL	STAT.	TEMPERATURE (DEG K)									
	(CM-1)	WT.	1200	1600	2000	2400	2800	3200	3600	4000	4400	
$2s^2 2p^4 \text{ } ^3P^o_2$	0	6	7.30E-01	7.21E-01	7.11E-01	7.03E-01	6.96E-01	6.90E-01	6.84E-01	6.78E-01		
	215	0.0353	2.82E-01	2.79E-01	2.69E-01	2.97E-01	3.02E-01	3.09E-01	3.11E-01	3.13E-01		
TEMPERATURE (DEG K)												
LEVEL			5000	6000	6400	6800	7200	7600	8000	8400	8800	9200
(CM-1)	0	6.09E-01	6.84E-01	6.83E-01	6.82E-01	6.81E-01	6.79E-01	6.78E-01	6.77E-01	6.77E-01	6.76E-01	6.74E-01
	205	3.15E-01	3.16E-01	3.17E-01	3.18E-01	3.19E-01	3.20E-01	3.21E-01	3.22E-01	3.23E-01	3.24E-01	3.24E-01
TEMPERATURE (DEG K)												
LEVEL			10000	12000	13000	14000	15000	16000	17000	18000	19000	20000
(CM-1)	0	6.76E-01	6.76E-01	6.74E-01	6.73E-01	6.73E-01	6.73E-01	6.72E-01	6.72E-01	6.72E-01	6.71E-01	6.71E-01
	205	3.24E-01	3.25E-01	3.26E-01	3.26E-01	3.27E-01	3.27E-01	3.28E-01	3.28E-01	3.29E-01	3.29E-01	3.29E-01
TEMPERATURE (DEG K)												
LEVEL			24000	26000	30000	40000	40000	40000	0	0	0	0
(CM-1)	0	6.70E-01	6.70E-01	6.69E-01	6.69E-01	6.69E-01	6.69E-01	6.69E-01	6.69E-01	6.69E-01	6.69E-01	6.69E-01
	205	3.30E-01	3.30E-01	3.30E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTANDARD ENERGY LEVELS FROM BERRY ET AL. (1965)



TABLE 47. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C

STATE	LEVEL	STAT.	TEMPERATURE (1000 K)									
			1200	1600	2000	2400	2800	3200	3600	4000	4400	
2s <sup>2</sup> 2p <sup>2</sup>	0	1	1.155-01	1.145-01	1.135-01	1.135-01	1.125-01	1.125-01	1.115-01	1.115-01	1.105-01	
	16	3	3.395-01	3.378-01	3.365-01	3.365-01	3.355-01	3.345-01	3.335-01	3.325-01	3.315-01	
	43	5	5.462-01	5.462-01	5.462-01	5.462-01	5.462-01	5.462-01	5.462-01	5.462-01	5.462-01	
	101.94	5	2.032-02	2.032-02	2.032-02	2.032-02	2.032-02	2.032-02	2.032-02	2.032-02	2.032-02	
	216.60	5	6.152-13	4.011-10	1.902-05	2.511-07	1.664-06	6.645-06	5.978-05	4.402-05	3.278-05	
2s 2p <sup>3</sup>	337.75	5	1.505-18	3.011-14	1.645-11	9.302-16	1.671-09	1.455-07	1.778-07	2.975-06	6.905-06	
	64.091	15	7.311-34	1.601-25	1.611-26	3.492-17	6.405-15	5.131-13	2.256-11	1.425-10	1.311-09	
	79.256	9	0.	4.101-34	3.145-24	2.592-20	1.631-17	2.038-15	8.008-14	1.792-12	2.028-11	
	109.001	3	0.	0.	3.601-34	9.445-29	8.265-25	7.392-22	5.445-19	6.092-16	3.111-16	
	978.770	5	0.	3.401-35	1.495-31	1.065-26	6.005-23	4.325-20	5.711-18	2.045-16	6.922-15	
2p <sup>4</sup>	119.770	3	0.	1.201-36	2.005-32	5.978-29	3.311-24	5.211-22	6.235-20	3.121-18	4.945-22	
	704.24	60	0.	0.	0.	0.	3.392-36	5.141-30	9.231-27	3.045-24	4.945-22	
	9.4933	12	0.	0.	0.	0.	3.892-36	7.061-32	2.101-29	1.151-25	2.011-23	
	60.046	36	0.	0.	0.	0.	0.	5.001-37	4.271-30	5.001-30	2.171-27	
	827.500	12	3.111-32	2.521-24	1.401-19	2.041-16	3.691-14	1.021-12	3.701-11	4.241-10	1.691-09	
2s 2p <sup>2</sup> (P)	60.722	36	2.091-36	3.421-27	2.041-22	2.041-18	1.121-15	9.791-14	3.171-12	5.121-11	4.971-10	
	704.24	60	0.	1.611-30	2.141-24	2.591-20	2.111-17	3.261-15	1.431-13	3.721-12	4.611-11	
	9.4933	12	0.	4.011-31	5.091-25	5.071-21	3.401-18	2.271-16	3.091-14	6.131-13	1.041-11	
	60.046	36	0.	1.001-31	2.231-25	3.091-21	3.401-18	4.531-16	3.091-14	9.291-13	1.201-11	
	827.500	60	0.	1.231-32	4.321-26	1.001-21	1.001-17	2.041-16	1.071-14	5.291-13	6.101-12	
2s 2p <sup>2</sup> (D)	84.000	64	0.	1.501-32	5.531-26	1.201-21	1.701-18	3.721-16	2.441-14	7.001-13	1.091-11	
	116.000	24	0.	0.	1.501-36	1.701-30	3.501-26	6.001-23	1.901-20	2.011-18	6.071-17	
	125.000	72	0.	0.	0.	2.321-32	3.151-27	1.511-24	1.611-21	2.371-19	1.401-17	
	132.000	120	0.	0.	0.	5.021-34	4.711-29	2.261-25	1.441-22	3.101-20	2.371-18	
	136.160	24	0.	0.	0.	9.541-36	1.101-30	6.911-27	6.191-24	1.431-21	1.211-19	
2s 2p <sup>2</sup> (F)	130.000	20	0.	0.	0.	2.441-36	3.591-31	2.531-27	2.401-24	6.131-22	5.591-20	
	145.000	60	0.	0.	0.	1.201-37	2.991-32	3.261-28	4.541-25	1.401-22	1.601-20	
	154.000	100	0.	0.	0.	0.	4.071-34	9.501-30	2.071-26	9.711-24	1.401-21	
	160.000	320	0.	0.	0.	0.	1.901-34	5.931-30	1.541-26	7.371-24	1.201-21	
	184.000	100	0.	0.	0.	0.	0.	1.421-35	1.391-31	2.141-26	6.601-24	
2p <sup>3</sup> (P)	21.0923	192	0.	0.	0.	0.	0.	2.021-37	4.541-33	1.001-29	5.941-27	
	21.0760	36	0.	0.	0.	0.	4.671-38	2.571-33	1.251-29	1.111-26	2.801-24	
	23.1924	64	0.	0.	0.	0.	0.	7.901-38	6.001-31	7.731-28	2.671-25	
	26.7799	72	0.	0.	0.	0.	0.	0.	2.591-37	1.441-33	1.471-30	
	27.0957	120	0.	0.	0.	0.	0.	0.	1.011-34	1.011-34	1.571-31	
2p <sup>3</sup> (D)	27.7217	100	0.	0.	0.	0.	0.	0.	0.	2.021-36	3.041-31	
	28.0376	320	0.	0.	0.	0.	0.	0.	0.	1.431-36	2.401-32	
	30.1274	100	0.	0.	0.	0.	0.	0.	0.	1.311-37	3.401-34	
	31.2432	192	0.	0.	0.	0.	0.	0.	0.	0.	3.431-35	

\*ESTIMATED \*\*INCLUDES ESTIMATED SURLEVELS  
NONSTABLE ENERGY LEVELS FROM MOORE (1949) AND NYHAGEN (1954, 1955)

TABLE 47 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	4000	5200	5400	6000	6400	6800	7200	7600	8000	8400
0	1.07E-01	1.00E-01	1.00E-01	1.07E-01	1.04E-01	1.05E-01	1.04E-01	1.03E-01	1.02E-01	1.01E-01
16	3.24E-01	3.24E-01	3.24E-01	3.19E-01	3.14E-01	3.13E-01	3.11E-01	3.08E-01	3.06E-01	3.04E-01
43	5.39E-01	5.39E-01	5.32E-01	5.28E-01	5.24E-01	5.19E-01	5.15E-01	5.11E-01	5.07E-01	5.03E-01
10194	2.51E-02	3.23E-02	3.23E-02	4.63E-02	4.63E-02	4.67E-02	4.78E-02	4.88E-02	4.94E-02	4.94E-02
21648	1.64E-04	2.71E-04	4.13E-04	5.94E-04	8.14E-04	1.07E-03	1.37E-03	1.71E-03	2.06E-03	2.49E-03
33735	2.22E-09	4.79E-09	9.25E-09	1.64E-08	4.17E-08	6.14E-08	8.48E-08	1.10E-07	1.57E-07	2.02E-07
64091	7.43E-09	3.29E-08	1.14E-07	3.30E-07	8.77E-07	2.14E-06	6.31E-06	1.51E-05	3.60E-05	8.43E-05
73256	1.57E-10	8.83E-10	3.88E-09	1.68E-08	4.20E-08	1.19E-07	2.74E-07	6.30E-07	1.22E-06	2.50E-06
102891	5.32E-15	6.29E-14	5.08E-14	3.07E-12	1.97E-12	5.96E-11	2.04E-10	6.19E-10	1.82E-09	5.24E-09
91878	9.90E-16	9.30E-15	6.44E-14	3.62E-11	1.47E-10	5.31E-10	1.67E-09	4.62E-09	1.16E-08	2.65E-08
119478	8.12E-17	1.20E-15	1.34E-14	1.05E-13	6.27E-13	3.69E-12	1.23E-11	4.31E-11	1.33E-10	3.40E-10
150000	2.92E-20	5.21E-19	1.77E-17	2.29E-16	2.19E-15	1.95E-14	8.08E-14	4.31E-13	1.77E-12	6.34E-12
153000	1.49E-21	5.60E-20	1.24E-18	1.07E-17	1.94E-16	1.59E-15	1.01E-14	3.73E-14	2.33E-13	8.04E-13
181000	2.99E-25	1.93E-23	6.04E-22	1.51E-20	2.25E-19	2.65E-18	2.04E-17	1.35E-16	7.49E-16	3.40E-15
60776	1.61E-06	6.47E-06	2.13E-05	5.99E-07	1.64E-06	3.27E-06	6.53E-06	1.23E-05	2.20E-05	3.60E-05
69722	3.30E-09	1.63E-08	6.43E-08	2.10E-07	5.93E-07	1.40E-06	3.33E-06	6.87E-06	1.32E-05	2.37E-05
78426	4.07E-10	2.45E-09	1.14E-08	1.40E-07	3.91E-07	9.75E-07	2.20E-06	4.59E-06	8.91E-06	1.63E-05
78104	8.70E-11	5.24E-10	2.44E-09	9.22E-09	2.95E-08	8.23E-08	2.09E-07	4.63E-07	9.59E-07	1.84E-06
80866	1.17E-10	7.40E-10	3.67E-09	1.45E-08	6.84E-08	1.40E-07	3.59E-07	9.33E-07	1.70E-06	3.52E-06
81559	7.94E-11	5.44E-10	2.64E-09	1.10E-08	4.13E-08	1.24E-07	3.30E-07	7.89E-07	1.73E-06	3.52E-06
94400	1.07E-10	7.33E-10	3.07E-09	1.60E-08	5.59E-08	1.60E-07	4.40E-07	1.07E-06	2.34E-06	4.80E-06
110000	2.00E-15	2.90E-14	2.94E-13	2.13E-12	1.20E-11	5.51E-11	2.14E-10	7.10E-10	2.13E-09	5.71E-09
125000	4.20E-16	7.44E-15	8.71E-14	7.37E-13	4.74E-12	2.64E-11	1.04E-10	3.92E-10	1.27E-09	3.67E-09
132000	9.90E-17	1.79E-15	2.41E-14	2.29E-13	1.64E-12	9.34E-12	4.37E-11	1.74E-10	6.00E-10	1.84E-09
136169	4.92E-18	1.13E-16	1.05E-15	1.69E-14	1.29E-13	7.73E-13	3.80E-12	1.50E-11	5.67E-11	1.81E-10
150000	2.37E-18	5.64E-17	8.59E-16	9.00E-15	4.37E-14	2.20E-13	9.29E-12	3.40E-11	1.10E-10	3.19E-10
165000	8.72E-19	2.45E-17	4.27E-16	5.07E-15	4.42E-14	2.90E-13	1.03E-12	3.05E-11	9.05E-11	3.05E-10
154000	9.79E-20	3.30E-18	7.04E-17	9.77E-16	9.74E-15	7.40E-14	4.40E-13	2.25E-12	9.37E-12	3.50E-11
150000	9.44E-20	3.50E-18	6.07E-17	1.10E-15	1.27E-14	1.02E-13	6.45E-13	3.37E-12	1.49E-11	5.72E-11
104000	1.31E-23	9.04E-22	3.42E-20	7.99E-19	1.24E-17	1.40E-16	1.21E-15	6.29E-14	2.25E-13	9.34E-13
194000	1.17E-24	1.01E-22	4.05E-21	1.20E-19	3.60E-17	3.60E-16	2.91E-16	2.22E-15	1.30E-14	7.21E-14
170000	2.91E-23	1.44E-20	4.16E-19	7.50E-18	9.61E-17	9.03E-16	6.40E-15	3.91E-14	1.94E-13	8.24E-13
179000	3.49E-23	2.15E-21	7.12E-20	1.56E-18	2.39E-17	2.39E-16	1.94E-15	1.27E-14	6.80E-14	3.14E-13
216000	5.90E-28	8.64E-26	6.13E-24	2.44E-22	6.20E-21	1.07E-19	1.34E-18	1.20E-17	9.90E-17	6.24E-16
225000	7.16E-29	1.27E-26	1.00E-24	5.09E-23	1.44E-21	2.63E-20	3.94E-19	6.10E-18	3.49E-17	2.30E-16
234000	1.34E-28	2.24E-26	1.94E-24	9.82E-23	2.57E-21	4.92E-20	6.79E-19	7.11E-18	5.07E-17	3.90E-16
235000	1.63E-29	3.45E-27	3.45E-25	1.89E-23	6.04E-22	1.30E-20	2.00E-18	2.30E-17	1.51E-16	9.10E-16
243000	2.74E-31	7.50E-29	6.92E-27	5.40E-25	2.15E-23	5.30E-22	9.13E-21	1.17E-19	1.14E-18	9.10E-18
252000	3.20E-32	1.04E-29	1.57E-27	1.17E-25	1.40E-23	1.40E-22	2.09E-21	3.70E-20	4.07E-19	3.49E-18

TABLE 47 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C

LEVEL	TEMPERATURE (1000 K)										
	9600	10000	11000	12000	13000	14000	15000	16000	17000	18000	20000
1C(1-1)											
0	9.89E-02	9.60E-02	9.40E-02	9.40E-02	9.20E-02	9.94E-02	8.77E-02	8.54E-02	8.30E-02	7.77E-02	7.44E-02
16	2.94E-01	2.93E-01	2.87E-01	2.81E-01	2.75E-01	2.69E-01	2.63E-01	2.54E-01	2.49E-01	2.41E-01	2.34E-01
43	6.91E-01	6.87E-01	6.77E-01	6.67E-01	6.58E-01	6.47E-01	6.37E-01	6.24E-01	6.14E-01	6.01E-01	5.78E-01
10194	1.07E-01	1.13E-01	1.24E-01	1.38E-01	1.49E-01	1.58E-01	1.65E-01	1.71E-01	1.75E-01	1.78E-01	1.80E-01
21648	3.69E-03	4.35E-03	5.63E-03	7.01E-03	8.35E-03	9.72E-03	1.10E-02	1.22E-02	1.33E-02	1.43E-02	1.52E-02
33735	3.19E-03	3.02E-03	2.82E-03	2.53E-03	2.10E-03	1.60E-03	1.17E-03	8.06E-04	5.49E-04	3.62E-04	2.30E-04
64091	9.98E-05	1.05E-04	1.09E-04	1.12E-04	1.15E-04	1.18E-04	1.21E-04	1.24E-04	1.27E-04	1.30E-04	1.33E-04
79234	1.12E-05	1.75E-05	4.90E-05	1.02E-04	2.00E-04	3.54E-04	5.79E-04	8.69E-04	1.28E-03	1.77E-03	2.34E-03
105401	3.85E-08	7.20E-07	2.81E-07	8.73E-07	2.27E-06	5.11E-06	1.03E-05	1.89E-05	3.22E-05	5.13E-05	7.73E-05
97078	2.10E-07	3.75E-07	1.32E-06	3.74E-06	9.08E-06	1.92E-05	3.47E-05	6.43E-05	1.05E-04	1.61E-04	2.35E-04
119478	4.67E-09	5.50E-09	4.44E-08	1.61E-07	4.77E-07	1.20E-06	2.67E-06	5.34E-06	9.77E-06	1.64E-05	2.64E-05
150000	1.53E-10	3.74E-10	2.40E-09	1.31E-08	5.10E-08	1.63E-07	4.65E-07	1.07E-06	2.39E-06	5.14E-06	1.09E-05
158000	2.57E-11	6.37E-11	5.00E-10	2.78E-09	1.17E-08	3.99E-08	1.15E-07	2.80E-07	6.67E-07	1.32E-06	2.47E-06
181000	1.64E-13	4.80E-13	5.02E-12	5.33E-11	1.83E-10	7.50E-10	2.53E-09	7.29E-09	1.85E-08	4.75E-08	1.14E-07
40774	1.31E-04	1.87E-04	4.04E-04	1.12E-03	1.32E-03	2.64E-03	3.09E-03	4.34E-03	5.81E-03	7.50E-03	9.35E-03
69722	1.03E-04	1.55E-04	3.78E-04	7.92E-04	1.47E-03	2.50E-03	3.94E-03	5.82E-03	8.10E-03	1.10E-02	1.43E-02
78424	4.64E-05	7.59E-05	2.02E-04	4.85E-04	9.30E-04	1.70E-03	2.89E-03	4.44E-03	6.33E-03	9.14E-03	1.23E-02
78184	9.64E-06	1.53E-05	4.17E-05	9.57E-05	1.93E-04	3.49E-04	5.93E-04	9.37E-04	1.33E-03	1.84E-03	2.50E-03
80844	1.94E-05	3.12E-05	8.81E-05	2.00E-04	4.30E-04	7.94E-04	1.25E-03	2.14E-03	3.19E-03	4.51E-03	6.13E-03
83850	2.07E-05	3.39E-05	9.93E-05	2.43E-04	5.15E-04	9.74E-04	1.69E-03	2.72E-03	4.12E-03	5.92E-03	8.19E-03
84000	2.83E-05	4.64E-05	1.34E-04	3.34E-04	7.08E-04	1.35E-03	2.33E-03	3.74E-03	5.70E-03	8.20E-03	1.13E-02
116000	6.88E-06	1.33E-05	5.93E-05	2.08E-04	5.84E-04	1.43E-03	3.10E-03	5.05E-03	7.89E-03	1.18E-02	1.75E-02
125000	5.28E-08	1.04E-07	5.40E-07	2.10E-06	6.50E-06	1.71E-05	3.92E-05	8.04E-05	1.52E-04	2.63E-04	4.33E-04
132000	3.04E-08	6.04E-08	3.64E-07	1.51E-06	4.92E-06	1.30E-05	3.34E-05	7.17E-05	1.40E-04	2.53E-04	4.28E-04
136149	3.25E-09	7.29E-09	4.24E-08	1.83E-07	6.29E-07	1.80E-06	4.48E-06	9.84E-06	1.97E-05	3.62E-05	6.70E-05
138000	2.04E-09	4.47E-09	2.78E-08	1.22E-07	4.28E-07	1.25E-06	3.13E-06	6.91E-06	1.41E-05	2.61E-05	4.30E-05
145000	2.14E-09	5.12E-09	3.34E-08	1.59E-07	5.92E-07	1.82E-06	4.60E-06	1.11E-05	2.33E-05	4.47E-05	7.94E-05
154000	9.35E-10	2.34E-09	1.71E-08	9.99E-08	3.44E-07	1.20E-06	3.37E-06	8.27E-06	1.81E-05	3.63E-05	6.70E-05
158000	1.64E-09	4.20E-09	3.25E-08	1.78E-07	7.49E-07	2.35E-06	7.05E-06	1.82E-05	4.14E-05	8.43E-05	1.54E-04
184000	1.13E-11	3.37E-11	3.64E-10	2.64E-09	1.42E-08	9.95E-08	2.05E-07	6.02E-07	1.55E-06	3.54E-06	7.44E-06
194000	4.47E-12	1.42E-11	1.76E-10	1.12E-09	9.34E-09	3.79E-08	1.40E-07	4.35E-07	1.10E-06	2.93E-06	6.22E-06
170000	3.04E-11	6.41E-11	7.61E-10	4.75E-09	2.35E-08	8.34E-08	2.62E-07	7.84E-07	1.89E-06	3.43E-06	7.18E-06
179000	1.41E-11	1.08E-11	4.17E-10	2.87E-09	1.47E-08	5.90E-08	1.84E-07	5.59E-07	1.40E-06	2.59E-06	4.92E-06
216000	4.21E-14	2.23E-13	3.83E-12	3.83E-11	3.83E-10	1.43E-09	4.76E-09	2.24E-08	6.87E-08	1.84E-07	4.41E-07
225000	2.84E-14	1.04E-13	2.03E-12	2.31E-11	1.80E-10	1.04E-09	4.76E-09	1.79E-08	5.70E-08	1.59E-07	3.94E-07
224000	4.69E-14	1.78E-13	3.26E-12	3.67E-11	2.83E-10	1.63E-09	7.37E-09	2.75E-08	8.73E-08	2.43E-07	1.37E-06
233000	2.14E-14	8.65E-14	1.70E-12	2.22E-11	1.84E-10	1.15E-09	5.52E-09	2.17E-08	7.25E-08	2.10E-07	5.41E-07
243000	1.63E-15	6.32E-15	1.63E-13	2.25E-12	2.07E-11	1.30E-10	7.14E-10	2.96E-09	1.02E-08	3.15E-08	9.54E-08
252000	7.51E-16	5.37E-15	8.92E-14	1.34E-12	1.34E-11	9.76E-11	5.34E-10	2.34E-09	8.71E-09	2.74E-08	7.69E-08

TABLE 47 (CONT.)-1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C

LEVEL (CM <sup>-1</sup> )	TEMPERATURE (DEG K)									
	24000	28000	32000	36200	40000	44000	48000	0	0	0
0	4.25E-02	5.04E-02	4.00E-02	3.17E-02	2.53E-02	2.05E-02	1.68E-02	0.	0.	0.
16	1.37E-01	1.51E-01	1.20E-01	9.51E-02	7.68E-02	6.15E-02	5.09E-02	0.	0.	0.
43	3.12E-01	2.52E-01	2.00E-01	1.50E-01	1.24E-01	1.02E-01	8.41E-02	0.	0.	0.
10104	1.70E-01	1.42E-01	1.27E-01	1.04E-01	8.78E-02	7.35E-02	6.20E-02	0.	0.	0.
21648	1.71E-02	1.66E-02	1.51E-02	1.33E-02	1.16E-02	1.01E-02	8.80E-03	0.	0.	0.
33735	4.14E-02	4.44E-02	4.39E-02	4.12E-02	3.74E-02	3.40E-02	3.04E-02	0.	0.	0.
44021	2.91E-02	2.81E-02	2.64E-02	2.47E-02	2.19E-02	1.96E-02	1.70E-02	0.	0.	0.
75256	6.18E-03	9.58E-03	1.23E-02	1.61E-02	1.52E-02	1.56E-02	1.56E-02	0.	0.	0.
102881	3.30E-04	6.59E-04	1.05E-03	1.39E-03	1.49E-03	1.93E-03	2.12E-03	0.	0.	0.
197878	8.95E-04	1.69E-03	2.49E-03	3.17E-03	3.75E-03	4.18E-03	4.48E-03	0.	0.	0.
119876	1.42E-04	3.20E-04	5.48E-04	7.90E-04	1.02E-03	1.23E-03	1.39E-03	0.	0.	0.
150000	7.09E-05	2.04E-04	4.24E-04	7.11E-04	1.03E-03	1.37E-03	1.69E-03	0.	0.	0.
150000	2.51E-05	7.51E-05	1.64E-04	2.87E-04	4.31E-04	5.82E-04	7.59E-04	0.	0.	0.
181000	1.21E-04	4.61E-04	1.17E-03	2.29E-03	3.77E-03	5.51E-03	7.42E-03	0.	0.	0.
60776	1.94E-02	2.64E-02	3.12E-02	3.59E-02	3.42E-02	3.37E-02	3.27E-02	0.	0.	0.
60722	3.45E-02	5.05E-02	6.27E-02	7.04E-02	7.43E-02	7.59E-02	7.50E-02	0.	0.	0.
70426	3.41E-02	5.36E-02	7.04E-02	8.26E-02	9.05E-02	9.47E-02	9.63E-02	0.	0.	0.
78184	4.91E-03	1.09E-02	1.43E-02	1.67E-02	1.83E-02	1.91E-02	1.94E-02	0.	0.	0.
80844	1.77E-02	2.85E-02	3.80E-02	4.51E-02	4.98E-02	5.25E-02	5.37E-02	0.	0.	0.
83830	2.44E-02	4.07E-02	5.53E-02	6.67E-02	7.45E-02	7.93E-02	8.18E-02	0.	0.	0.
84000	3.42E-02	5.64E-02	7.70E-02	9.20E-02	1.04E-01	1.10E-01	1.14E-01	0.	0.	0.
116000	1.43E-03	3.12E-03	5.22E-03	7.38E-03	9.37E-03	1.11E-02	1.25E-02	0.	0.	0.
125000	2.51E-03	5.98E-03	1.04E-02	1.54E-02	2.03E-02	2.48E-02	2.84E-02	0.	0.	0.
132000	2.78E-03	6.84E-03	1.27E-02	1.95E-02	2.64E-02	3.20E-02	3.81E-02	0.	0.	0.
136169	4.28E-04	1.11E-03	2.11E-03	3.30E-03	4.54E-03	5.73E-03	6.82E-03	0.	0.	0.
136060	3.19E-04	8.40E-04	1.62E-03	2.55E-03	3.54E-03	4.59E-03	5.34E-03	0.	0.	0.
145000	5.36E-04	1.76E-03	3.54E-03	5.79E-03	8.26E-03	1.07E-02	1.31E-02	0.	0.	0.
150000	6.12E-04	1.89E-03	3.94E-03	6.73E-03	9.90E-03	1.33E-02	1.73E-02	0.	0.	0.
150000	1.54E-03	4.81E-03	1.09E-02	1.84E-02	2.76E-02	3.74E-02	4.73E-02	0.	0.	0.
184000	1.09E-04	4.27E-04	1.10E-03	2.19E-03	3.65E-03	5.40E-03	7.32E-03	0.	0.	0.
194000	1.07E-04	4.94E-04	1.25E-03	2.61E-03	4.33E-03	6.92E-03	9.64E-03	0.	0.	0.
170000	8.44E-05	2.92E-04	6.90E-04	1.28E-03	2.02E-03	2.84E-03	3.71E-03	0.	0.	0.
170000	8.75E-05	3.27E-04	8.19E-04	1.59E-03	2.59E-03	3.77E-03	5.04E-03	0.	0.	0.
214000	1.07E-05	5.19E-05	1.79E-04	4.07E-04	7.71E-04	1.26E-03	1.87E-03	0.	0.	0.
225000	1.11E-05	6.15E-05	2.07E-04	5.09E-04	9.91E-04	1.67E-03	2.54E-03	0.	0.	0.
230000	1.64E-05	9.18E-05	3.04E-04	7.39E-04	1.44E-03	2.43E-03	3.68E-03	0.	0.	0.
230000	1.72E-05	1.02E-04	3.61E-04	9.17E-04	1.66E-03	2.82E-03	4.99E-03	0.	0.	0.
245000	3.18E-04	2.04E-03	7.77E-03	2.07E-04	4.38E-04	7.84E-04	1.25E-03	0.	0.	0.
252000	3.36E-04	2.30E-03	9.22E-03	2.57E-04	5.63E-04	1.04E-03	1.70E-03	0.	0.	0.

TABLE 40. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N

STATE	LEVEL (CM-1)	STAT. WT.	TEMPERATURE (DEG K)									
			1200	1400	2000	2400	3000	3400	4000	4400	4800	5400
2s 2p <sup>3</sup>	0	4	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
	19228	10	2.43E-10	7.74E-08	2.44E-06	2.44E-05	1.21E-04	4.40E-04	1.15E-03	2.47E-03	4.53E-03	7.92E-03
	28639	6	1.44E-15	8.19E-12	1.07E-09	4.68E-08	5.90E-07	3.50E-06	1.44E-05	4.68E-05	1.20E-04	2.80E-04
	88132	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2s 2p <sup>2</sup> 3s	121000	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	142110	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	158200	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	232900	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2s 2p <sup>2</sup> 3p	84288	18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	95780	54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	104501	18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	118749	54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3s 3p	104661	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	128708	18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	133180	54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	136770	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(D)	110441	126	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	123544	18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	137505	54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	150017	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(S)	124000	160	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	144104	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	159192	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	170474	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2s 2p <sup>2</sup> 3s 3p	142000	32	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	159091	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	193410	160	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	230044	270	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2s 2p <sup>2</sup> 3s 3p 3d	230044	480	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	250442	480	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	266559	480	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	321111	750	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2s 2p <sup>2</sup> 3s 3p 3d 3f	331000	750	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	341000	750	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	351000	750	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	361000	750	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
 MONITORING ENERGY LEVELS FROM MOORE (1949), ERIKSSON (1950), AND ERIKSSON AND JOHANSSON (1961)

TABLE 40 (CONT.-). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N

LEVEL (CM-1)	TEMPERATURE (CEG N)									
	4000	5200	5600	6000	6400	6800	7200	7600	8000	8400
0	9.92E-01	9.07E-01	9.82E-01	9.74E-01	9.64E-01	9.54E-01	9.45E-01	9.33E-01	9.20E-01	9.06E-01
19228	7.79E-03	1.21E-02	1.76E-02	2.42E-02	3.20E-02	4.09E-02	5.07E-02	6.12E-02	7.24E-02	8.41E-02
28039	2.62E-04	5.07E-04	9.31E-04	1.45E-03	2.20E-03	3.21E-03	4.45E-03	5.95E-03	7.71E-03	9.73E-03
81132	1.00E-11	7.61E-11	4.32E-10	1.94E-09	7.32E-09	2.79E-08	6.37E-08	1.49E-07	3.61E-07	7.54E-07
121000	4.39E-16	7.12E-15	7.73E-14	6.10E-13	3.71E-12	1.82E-11	7.45E-11	2.83E-10	8.14E-10	2.26E-09
142110	1.57E-19	4.14E-18	6.02E-17	7.73E-16	6.44E-15	4.10E-14	2.19E-13	9.65E-13	3.65E-12	1.22E-11
156260	3.79E-21	1.45E-19	3.26E-18	4.69E-17	4.69E-16	4.16E-15	2.64E-14	1.38E-13	6.07E-13	2.32E-12
232900	7.14E-31	1.53E-28	1.52E-26	6.13E-25	2.44E-23	5.69E-22	6.69E-21	9.94E-20	8.04E-19	6.43E-18
84288	4.74E-11	3.31E-10	1.74E-09	7.31E-09	2.64E-08	7.73E-08	2.06E-07	4.93E-07	1.04E-06	2.19E-06
95780	4.55E-12	4.12E-11	2.78E-10	1.39E-09	5.01E-09	2.04E-08	6.21E-08	1.68E-07	4.10E-07	9.12E-07
104041	4.99E-13	5.57E-12	4.40E-11	2.63E-10	1.24E-09	4.90E-09	1.69E-08	5.02E-08	1.34E-07	3.23E-07
103841	1.35E-13	1.57E-12	1.14E-11	6.69E-11	3.53E-10	1.23E-09	4.12E-09	1.21E-08	3.20E-08	7.64E-08
107420	1.79E-13	1.95E-12	1.37E-11	8.55E-11	4.24E-10	1.74E-09	6.07E-09	1.85E-08	5.04E-08	1.25E-07
110315	9.73E-14	1.23E-12	1.08E-11	7.12E-11	3.69E-10	1.57E-09	5.67E-09	1.79E-08	5.01E-08	1.27E-07
110441	1.51E-13	1.67E-12	1.47E-11	9.67E-11	5.02E-10	2.14E-09	7.76E-09	2.44E-08	6.89E-08	1.74E-07
99464	2.63E-13	2.61E-12	1.80E-11	1.02E-10	4.49E-10	1.64E-09	5.30E-09	1.49E-08	3.78E-08	8.74E-08
110973	2.64E-14	3.42E-13	3.05E-12	2.03E-11	1.04E-10	4.59E-10	1.64E-09	5.26E-09	1.48E-08	3.78E-08
121000C	2.20E-15	3.54E-14	3.07E-13	3.05E-12	1.95E-11	9.69E-11	3.73E-10	4.07E-09	4.07E-09	1.13E-08
124406	2.39E-15	4.41E-14	4.01E-13	4.12E-12	2.44E-11	1.34E-10	5.81E-10	2.13E-09	6.82E-09	1.53E-08
114279	3.62E-16	5.24E-15	5.20E-14	3.70E-13	2.14E-12	9.07E-12	3.83E-11	1.20E-10	3.81E-10	1.01E-09
120400	2.07E-17	5.51E-16	6.93E-15	6.21E-14	4.21E-13	2.30E-12	1.02E-11	3.88E-11	1.29E-10	3.82E-10
137900	3.12E-18	7.41E-17	1.12E-15	1.17E-14	9.08E-14	5.54E-13	2.74E-12	1.14E-11	1.34E-10	1.34E-10
162000	2.40E-18	6.02E-17	1.12E-15	1.27E-14	1.04E-13	6.04E-13	3.59E-12	1.50E-11	5.94E-11	1.50E-10
152000	2.70E-19	9.15E-18	1.07E-16	1.07E-15	2.31E-14	1.80E-13	1.12E-12	5.32E-12	2.33E-11	8.47E-11
154000	1.95E-19	7.09E-18	1.54E-16	2.21E-15	2.27E-14	1.77E-13	1.09E-12	5.57E-12	2.44E-11	9.01E-11
192000	6.70E-24	3.63E-22	2.50E-20	4.65E-19	1.17E-17	1.47E-16	1.39E-15	1.03E-14	6.24E-14	3.19E-13
202000	6.02E-25	4.51E-23	3.40E-21	1.07E-19	2.20E-18	3.15E-17	3.54E-16	2.76E-15	1.84E-14	1.02E-13
215000	1.15E-26	1.62E-24	1.13E-22	4.44E-21	1.11E-19	1.80E-18	2.33E-17	2.21E-16	1.67E-15	1.04E-14
259000	2.62E-32	1.62E-29	1.70E-27	1.43E-25	6.95E-24	2.80E-22	4.31E-21	6.51E-20	7.45E-19	4.99E-18
331000	0.	0.	2.14E-35	6.17E-33	8.73E-31	6.00E-29	3.33E-27	1.07E-25	2.42E-24	4.03E-23
									5.25E-22	5.43E-21

TABLE 48 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF H

LEVEL (C2-1)	TEMPERATURE (1000 K)									
	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000
0	8.42E-01	8.47E-01	8.50E-01	7.71E-01	7.39E-01	7.00E-01	6.60E-01	6.37E-01	6.00E-01	5.80E-01
19230	1.21E-01	1.37E-01	1.63E-01	1.93E-01	2.19E-01	2.43E-01	2.64E-01	2.83E-01	2.99E-01	3.12E-01
20030	1.72E-02	2.00E-02	2.39E-02	3.04E-02	3.93E-02	5.43E-02	7.39E-02	1.01E-01	1.34E-01	1.74E-01
20132	6.74E-04	2.39E-04	2.39E-04	5.94E-05	1.29E-04	2.40E-04	4.77E-04	9.91E-04	1.95E-03	3.52E-03
121000	2.87E-00	2.82E-00	2.70E-07	9.44E-07	2.81E-06	6.96E-06	1.52E-05	3.60E-05	5.43E-05	9.14E-05
142110	2.42E-10	3.42E-09	1.42E-09	1.33E-09	5.43E-09	1.54E-07	4.92E-07	9.90E-07	1.62E-06	3.30E-06
150300	6.82E-11	1.40E-10	1.29E-09	6.09E-09	2.74E-08	9.13E-08	2.97E-07	1.04E-06	3.49E-06	9.02E-06
237000	8.94E-16	3.54E-15	7.14E-14	6.62E-13	7.04E-12	4.23E-11	1.99E-10	7.47E-10	2.18E-09	7.14E-09
84200	1.27E-05	2.04E-05	5.97E-05	1.42E-04	2.94E-04	5.40E-04	9.44E-04	1.47E-03	2.18E-03	3.16E-03
97700	6.75E-06	1.18E-05	3.94E-05	1.07E-04	2.47E-04	5.62E-04	9.23E-04	1.54E-03	2.40E-03	3.71E-03
100401	2.90E-06	5.34E-06	2.01E-05	6.01E-05	1.51E-04	3.29E-04	6.44E-04	1.13E-03	1.91E-03	2.99E-03
107001	6.74E-07	1.23E-06	4.50E-06	1.30E-05	3.37E-05	7.29E-05	1.42E-04	2.52E-04	4.17E-04	6.40E-04
107430	1.19E-06	2.22E-06	6.63E-06	2.09E-05	6.01E-05	1.52E-04	3.02E-04	5.49E-04	9.23E-04	1.46E-03
110710	1.20E-06	2.44E-06	9.89E-06	3.13E-05	6.24E-05	1.00E-04	3.82E-04	7.07E-04	1.21E-03	1.97E-03
110041	1.74E-06	3.32E-06	1.34E-05	4.31E-05	1.14E-04	2.60E-04	5.20E-04	9.74E-04	1.67E-03	2.60E-03
99044	7.02E-07	1.29E-06	4.61E-06	1.29E-05	3.90E-05	6.24E-05	1.10E-04	2.04E-04	3.30E-04	5.03E-04
110773	3.07E-07	7.39E-07	3.01E-06	9.63E-06	2.50E-05	5.00E-05	1.10E-04	2.22E-04	5.00E-04	6.11E-04
121000	1.43E-07	2.91E-07	1.30E-06	4.02E-06	1.40E-05	3.40E-05	7.61E-05	1.50E-04	2.71E-04	4.57E-04
124000	2.66E-07	5.23E-07	2.70E-06	1.00E-05	3.61E-05	7.70E-05	1.73E-04	3.47E-04	6.40E-04	1.10E-03
116279	1.16E-06	2.30E-06	1.00E-07	3.40E-07	9.44E-07	2.24E-06	4.79E-06	9.17E-06	1.62E-05	2.67E-05
120000	3.60E-09	1.20E-08	6.17E-08	2.30E-07	7.42E-07	1.95E-06	4.40E-06	9.29E-06	1.74E-05	3.04E-05
137000	2.42E-09	5.42E-09	3.13E-08	1.33E-07	4.52E-07	1.20E-06	3.13E-06	6.60E-06	1.34E-05	2.49E-05
143000	3.94E-09	9.00E-09	5.59E-08	2.49E-07	8.79E-07	2.57E-06	6.49E-06	1.45E-05	2.94E-05	5.44E-05
150000	2.13E-09	5.24E-09	3.70E-08	1.07E-07	7.32E-07	2.34E-06	6.34E-06	1.52E-05	3.23E-05	6.37E-05
156000	2.42E-09	6.02E-09	4.95E-08	2.22E-07	9.32E-07	3.05E-06	8.40E-06	2.04E-05	4.49E-05	8.92E-05
160000	1.94E-11	5.79E-11	6.77E-10	5.23E-09	2.92E-08	1.27E-07	4.59E-07	1.37E-06	3.60E-06	6.47E-06
203000	7.34E-12	2.42E-11	3.29E-10	2.00E-09	1.72E-08	8.11E-08	3.80E-07	2.74E-06	6.77E-06	1.51E-05
215000	9.03E-13	3.00E-12	5.57E-11	5.52E-10	3.03E-09	2.00E-08	8.31E-08	2.80E-07	8.44E-07	2.24E-06
250000	1.64E-13	7.83E-13	2.15E-12	3.44E-12	3.50E-11	2.69E-10	1.49E-09	6.72E-09	2.52E-08	8.14E-08
331000	4.61E-20	3.30E-19	2.59E-17	6.40E-16	1.70E-14	2.21E-13	2.04E-12	1.91E-11	7.77E-11	3.52E-10

TABLE 48 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	24000	28000	32000	36000	40000	44000	48000	0	0	0
0	4.24E-01	3.33E-01	2.53E-01	1.91E-01	1.45E-01	1.12E-01	8.79E-02	0.	0.	0.
19228	3.36E-01	3.10E-01	2.67E-01	2.22E-01	1.82E-01	1.49E-01	1.24E-01	0.	0.	0.
28939	1.13E-01	1.04E-01	9.04E-02	7.72E-02	6.54E-02	5.54E-02	4.74E-02	0.	0.	0.
88132	1.48E-02	1.49E-02	1.45E-02	1.40E-02	1.35E-02	1.30E-02	1.25E-02	0.	0.	0.
121000	7.53E-04	1.64E-03	2.75E-03	3.80E-03	4.67E-03	5.39E-03	5.95E-03	0.	0.	0.
142110	4.25E-05	1.12E-04	2.13E-04	3.27E-04	4.59E-04	5.37E-04	6.21E-04	0.	0.	0.
158200	4.04E-05	1.47E-04	3.10E-04	5.15E-04	7.54E-04	9.51E-04	1.15E-03	0.	0.	0.
232800	5.52E-07	3.17E-04	1.08E-03	2.60E-03	5.01E-03	8.27E-03	1.23E-02	0.	0.	0.
84288	1.22E-02	1.37E-02	2.58E-02	2.94E-02	3.15E-02	3.26E-02	3.14E-02	0.	0.	0.
95780	1.64E-02	3.27E-02	4.61E-02	5.62E-02	6.25E-02	6.57E-02	6.72E-02	0.	0.	0.
104461	1.70E-02	3.42E-02	5.11E-02	6.51E-02	7.52E-02	8.14E-02	8.53E-02	0.	0.	0.
103861	3.79E-03	7.28E-03	1.07E-02	1.36E-02	1.56E-02	1.69E-02	1.78E-02	0.	0.	0.
107420	9.18E-03	1.88E-02	2.73E-02	3.53E-02	4.11E-02	4.51E-02	4.74E-02	0.	0.	0.
110315	1.29E-02	2.59E-02	4.09E-02	5.24E-02	6.18E-02	6.83E-02	7.25E-02	0.	0.	0.
110441	1.79E-02	3.48E-02	5.57E-02	7.29E-02	8.61E-02	9.52E-02	1.01E-01	0.	0.	0.
99664	2.71E-03	4.97E-03	7.17E-03	8.90E-03	1.01E-02	1.08E-02	1.11E-02	0.	0.	0.
110973	4.12E-03	8.33E-03	1.29E-02	1.70E-02	2.01E-02	2.23E-02	2.37E-02	0.	0.	0.
121030	3.77E-03	8.30E-03	1.37E-02	1.90E-02	2.34E-02	2.64E-02	2.92E-02	0.	0.	0.
124400	9.71E-03	2.21E-02	3.74E-02	5.26E-02	6.57E-02	7.61E-02	8.40E-02	0.	0.	0.
116279	2.00E-04	4.23E-04	6.88E-04	9.17E-04	1.11E-03	1.29E-03	1.39E-03	0.	0.	0.
128400	2.90E-04	6.81E-04	1.18E-03	1.63E-03	2.12E-03	2.52E-03	2.81E-03	0.	0.	0.
137500	2.80E-04	7.11E-04	1.31E-03	1.94E-03	2.56E-03	3.12E-03	3.54E-03	0.	0.	0.
142000	6.04E-04	1.60E-03	3.42E-03	5.25E-03	7.03E-03	8.65E-03	9.97E-03	0.	0.	0.
133800	9.95E-04	2.88E-03	5.07E-03	7.51E-03	1.03E-02	1.49E-02	2.02E-02	0.	0.	0.
156000	1.40E-03	4.39E-03	9.11E-03	1.59E-02	2.12E-02	2.73E-02	3.28E-02	0.	0.	0.
192000	2.80E-04	1.17E-03	3.25E-03	4.00E-03	4.82E-03	5.42E-03	1.00E-02	0.	0.	0.
202000	2.81E-04	1.24E-03	3.44E-03	7.15E-03	1.22E-02	1.82E-02	2.48E-02	0.	0.	0.
215000	1.21E-04	5.94E-04	1.81E-03	3.99E-03	7.15E-03	1.11E-02	1.57E-02	0.	0.	0.
230000	1.04E-05	7.68E-05	3.05E-04	8.40E-04	1.80E-03	3.23E-03	5.14E-03	0.	0.	0.
331000	1.93E-07	2.54E-06	1.63E-05	4.45E-05	1.04E-04	4.18E-04	8.69E-04	0.	0.	0.



TABLE 4-1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O

STATE	LEVEL (CM-1)	STAT.	TEMPERATURE (800 K)									
			1200	1600	2000	2400	2800	3200	3600	4000	4400	4800
2p <sup>2</sup> 3p <sup>2</sup>	0	5	6.07E-01	5.94E-01	5.70E-01	5.41E-01	5.15E-01	4.93E-01	4.75E-01	4.60E-01	4.48E-01	4.38E-01
	120	3	3.01E-01	3.00E-01	3.15E-01	3.17E-01	3.15E-01	3.12E-01	3.22E-01	3.23E-01	3.24E-01	3.24E-01
	226	1	9.27E-02	9.49E-02	9.74E-02	1.01E-01	1.04E-01	1.04E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01
	15004	5	3.31E-09	3.77E-07	4.44E-06	4.30E-05	1.44E-04	4.50E-04	1.04E-03	1.05E-03	1.05E-03	1.05E-03
	53792	1	3.00E-19	7.53E-15	3.25E-12	1.05E-10	3.32E-09	2.90E-08	1.50E-07	6.00E-07	1.00E-06	1.00E-06
2p <sup>2</sup> 3p <sup>2</sup> (5)	126304	9	0.	0.	0.	1.7E-33	6.77E-29	2.29E-25	1.23E-22	1.93E-20	1.10E-18	1.10E-18
	109037	3	0.	0.	0.	0.	0.	2.94E-30	3.09E-34	7.50E-31	3.70E-28	3.70E-28
	277000	1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	74003	8	0.	5.32E-20	3.72E-24	2.00E-20	1.70E-17	2.17E-15	9.13E-14	6.10E-12	2.09E-11	2.09E-11
	87379	24	0.	2.14E-30	1.41E-27	4.00E-23	8.77E-20	2.30E-17	1.07E-15	6.13E-14	1.00E-12	1.00E-12
2p <sup>2</sup> 3p <sup>2</sup> (7)	97443	40	0.	6.19E-30	1.40E-26	1.00E-25	6.34E-22	4.31E-19	5.90E-17	2.70E-15	6.90E-14	6.90E-14
	95757	8	0.	3.01E-30	1.14E-26	1.00E-25	3.90E-22	1.04E-19	2.10E-17	1.00E-15	1.00E-14	1.00E-14
	99314	24	0.	2.04E-31	2.04E-26	1.00E-25	1.04E-22	1.12E-19	3.50E-17	8.37E-16	2.10E-14	2.10E-14
	102900	116	0.	0.	9.00E-32	2.10E-26	1.40E-22	1.00E-19	1.03E-17	1.11E-15	3.20E-14	3.20E-14
	101323	20	0.	4.40E-32	6.90E-27	5.10E-23	3.45E-20	3.45E-18	5.47E-16	3.13E-14	6.00E-13	6.00E-13
2p <sup>2</sup> 3p <sup>2</sup> (9)	113400	60	0.	2.27E-35	3.00E-29	3.00E-25	4.53E-22	1.32E-19	1.32E-17	1.70E-15	5.02E-14	5.02E-14
	123000	100	0.	0.	0.	6.20E-32	2.53E-27	7.23E-24	3.52E-21	4.00E-19	2.00E-17	2.00E-17
	120700	320	0.	0.	0.	1.12E-32	7.02E-28	2.72E-24	1.40E-21	2.07E-19	1.00E-17	1.00E-17
	115416	12	0.	0.	2.52E-36	2.17E-30	9.04E-26	6.20E-23	1.00E-20	1.00E-18	7.00E-17	7.00E-17
	127000	36	0.	0.	0.	2.10E-33	1.10E-28	4.30E-25	2.40E-22	4.30E-20	2.01E-18	2.01E-18
2p <sup>2</sup> 3p <sup>2</sup> (11)	130000	60	0.	0.	0.	8.21E-34	1.11E-30	7.70E-27	1.00E-24	1.00E-21	1.70E-19	1.70E-19
	142100	192	0.	0.	0.	2.25E-36	4.31E-31	3.97E-27	4.30E-24	1.00E-21	1.00E-19	1.00E-19
	212000	216	0.	0.	0.	0.	0.	0.	3.04E-24	1.00E-21	1.00E-19	1.00E-19
	222000	304	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	250000	180	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p <sup>2</sup> 3p <sup>2</sup> (13)	260000	320	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	267000	36	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	290000	64	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	300000	100	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	314000	192	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p <sup>2</sup> 3p <sup>2</sup> (15)	409000	100	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	419000	192	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUMLEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949) AND BOWEN (1975)

TABLE 49 (CONT.) 1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O

LEVEL (C-1)	TEMPERATURE (DEG K)									
	4000	5200	5600	6000	6400	6800	7200	7600	8000	8400
0	5.64E-01	5.64E-01	5.61E-01	5.59E-01	5.56E-01	5.51E-01	5.43E-01	5.49E-01	5.40E-01	5.40E-01
150	3.24E-01	3.24E-01	3.23E-01	3.23E-01	3.21E-01	3.20E-01	3.17E-01	3.18E-01	3.16E-01	3.14E-01
226	2.04E-01	1.04E-01	1.04E-01	1.04E-01	1.04E-01	1.04E-01	1.04E-01	1.04E-01	1.04E-01	1.04E-01
15444	6.04E-03	9.52E-03	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02
33792	9.00E-04	9.00E-04	9.00E-04	9.00E-04	9.00E-04	9.00E-04	9.00E-04	9.00E-04	9.00E-04	9.00E-04
126304	3.42E-17	6.74E-16	6.19E-15	7.04E-14	4.47E-13	2.47E-12	1.09E-11	1.34E-10	1.04E-09	2.55E-09
189317	6.04E-26	5.22E-24	2.21E-22	5.49E-21	9.75E-20	1.10E-18	1.11E-17	6.07E-16	4.11E-14	4.11E-14
277000	9.04E-38	9.04E-35	1.39E-32	1.39E-30	1.00E-28	3.90E-27	1.81E-25	2.45E-23	2.31E-21	1.65E-20
74993	1.61E-10	9.00E-10	1.42E-09	1.42E-08	9.35E-08	1.16E-07	2.78E-07	6.09E-07	2.35E-06	7.02E-06
87379	1.13E-11	8.54E-11	6.79E-10	2.13E-09	7.04E-09	2.40E-08	6.91E-08	1.72E-07	1.62E-06	2.95E-06
97443	9.39E-13	8.01E-12	6.02E-11	3.10E-10	1.34E-09	4.92E-09	1.54E-08	4.27E-08	2.45E-07	1.03E-06
95757	3.10E-13	2.01E-12	1.04E-11	9.53E-11	3.90E-10	1.41E-09	4.31E-09	1.05E-08	1.37E-07	2.04E-07
99314	3.20E-13	3.15E-12	2.23E-11	1.22E-10	5.37E-10	1.90E-09	6.34E-09	1.00E-08	1.07E-07	2.30E-07
102500	5.20E-13	5.64E-12	4.29E-11	2.40E-10	1.14E-09	4.50E-09	1.50E-08	4.11E-08	2.79E-07	1.20E-06
101223	1.30E-13	1.42E-11	1.00E-11	9.00E-11	2.72E-10	1.04E-09	3.41E-09	9.04E-09	1.33E-07	2.73E-07
113400	1.11E-14	1.51E-13	1.42E-12	9.90E-12	5.61E-11	2.42E-10	9.15E-10	3.77E-09	2.31E-08	5.54E-08
123940	6.30E-16	1.44E-14	1.44E-13	1.34E-12	8.02E-12	4.52E-11	1.73E-10	7.00E-10	1.71E-09	4.10E-09
128700	1.73E-15	2.41E-14	1.57E-13	1.41E-12	9.60E-12	5.29E-11	2.59E-10	3.04E-09	9.27E-09	6.23E-09
114414	1.73E-15	2.41E-14	1.57E-13	1.41E-12	9.60E-12	5.29E-11	2.59E-10	3.04E-09	9.27E-09	6.23E-09
127900	9.12E-17	1.73E-15	2.16E-14	1.93E-13	1.30E-12	7.04E-12	3.15E-11	1.70E-10	4.02E-09	7.95E-09
130000	7.34E-16	1.77E-16	2.69E-15	2.69E-14	2.64E-13	1.39E-12	6.00E-12	2.97E-11	1.03E-09	2.73E-09
142100	6.09E-16	1.02E-16	3.04E-15	3.41E-14	2.04E-13	1.04E-12	9.03E-12	4.37E-11	1.40E-09	4.00E-09
212000	6.17E-17	8.15E-15	5.34E-13	2.01E-11	4.01E-10	7.91E-09	9.51E-08	6.00E-07	3.00E-06	9.25E-06
222000	5.47E-18	9.11E-16	7.30E-14	3.24E-12	9.04E-11	2.39E-10	2.39E-09	1.20E-08	7.13E-08	3.44E-07
230000	3.20E-13	2.02E-10	3.29E-08	2.71E-06	1.29E-04	3.41E-03	8.07E-02	1.21E-01	1.20E-01	5.79E-01
240000	4.60E-14	2.29E-11	4.40E-09	4.40E-07	2.43E-05	8.37E-04	1.94E-02	3.24E-01	4.00E-01	2.14E-01
287000	1.77E-17	1.32E-14	3.02E-12	5.10E-10	3.02E-08	1.60E-06	4.91E-05	9.90E-04	1.50E-02	1.24E-01
294000	0.	1.12E-15	4.03E-13	6.60E-11	5.72E-09	2.93E-07	9.40E-06	2.11E-05	4.70E-04	3.95E-03
304000	0.	3.59E-16	1.45E-13	2.64E-11	2.31E-09	1.39E-07	4.95E-06	1.20E-05	2.07E-04	2.61E-03
314000	0.	4.01E-17	1.00E-14	4.37E-12	4.71E-10	2.00E-08	1.19E-06	3.21E-05	6.24E-04	9.71E-03
400000	0.	0.	0.	0.	0.	3.12E-17	3.00E-15	2.70E-13	1.30E-11	1.04E-09
410000	0.	0.	0.	0.	0.	9.17E-16	7.40E-14	3.97E-12	1.41E-10	3.07E-09

TABLE 49 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O

LEVEL	TEMPERATURE (255 K)										
	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000	20000
0	5.34E-01	5.31E-01	5.24E-01	5.14E-01	5.00E-01	4.82E-01	4.60E-01	4.35E-01	4.08E-01	3.79E-01	3.48E-01
154	3.13E-01	3.11E-01	3.06E-01	3.00E-01	2.97E-01	2.92E-01	2.87E-01	2.82E-01	2.77E-01	2.72E-01	2.67E-01
226	1.03E-01	1.02E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01
15040	4.92E-02	4.91E-02	4.90E-02	4.89E-02	4.88E-02	4.87E-02	4.86E-02	4.85E-02	4.84E-02	4.83E-02	4.82E-02
31792	6.74E-04	6.71E-04	6.68E-04	6.65E-04	6.62E-04	6.59E-04	6.56E-04	6.53E-04	6.50E-04	6.47E-04	6.44E-04
126304	5.76E-09	5.72E-09	5.68E-09	5.64E-09	5.60E-09	5.56E-09	5.52E-09	5.48E-09	5.44E-09	5.40E-09	5.36E-09
109037	1.11E-13	1.10E-13	1.09E-13	1.08E-13	1.07E-13	1.06E-13	1.05E-13	1.04E-13	1.03E-13	1.02E-13	1.01E-13
277000	9.97E-20	9.95E-20	9.93E-20	9.91E-20	9.89E-20	9.87E-20	9.85E-20	9.83E-20	9.81E-20	9.79E-20	9.77E-20
74903	1.14E-05	1.13E-05	1.12E-05	1.11E-05	1.10E-05	1.09E-05	1.08E-05	1.07E-05	1.06E-05	1.05E-05	1.04E-05
87370	5.26E-06	5.24E-06	5.22E-06	5.20E-06	5.18E-06	5.16E-06	5.14E-06	5.12E-06	5.10E-06	5.08E-06	5.06E-06
97443	1.94E-06	1.92E-06	1.90E-06	1.88E-06	1.86E-06	1.84E-06	1.82E-06	1.80E-06	1.78E-06	1.76E-06	1.74E-06
95737	1.00E-07	9.98E-07	9.96E-07	9.94E-07	9.92E-07	9.90E-07	9.88E-07	9.86E-07	9.84E-07	9.82E-07	9.80E-07
99314	2.80E-07	2.78E-07	2.76E-07	2.74E-07	2.72E-07	2.70E-07	2.68E-07	2.66E-07	2.64E-07	2.62E-07	2.60E-07
102700	2.40E-06	2.38E-06	2.36E-06	2.34E-06	2.32E-06	2.30E-06	2.28E-06	2.26E-06	2.24E-06	2.22E-06	2.20E-06
101523	5.86E-07	5.84E-07	5.82E-07	5.80E-07	5.78E-07	5.76E-07	5.74E-07	5.72E-07	5.70E-07	5.68E-07	5.66E-07
113000	2.50E-07	2.48E-07	2.46E-07	2.44E-07	2.42E-07	2.40E-07	2.38E-07	2.36E-07	2.34E-07	2.32E-07	2.30E-07
123940	1.91E-07	1.89E-07	1.87E-07	1.85E-07	1.83E-07	1.81E-07	1.79E-07	1.77E-07	1.75E-07	1.73E-07	1.71E-07
120700	1.53E-07	1.51E-07	1.49E-07	1.47E-07	1.45E-07	1.43E-07	1.41E-07	1.39E-07	1.37E-07	1.35E-07	1.33E-07
110416	4.97E-08	4.95E-08	4.93E-08	4.91E-08	4.89E-08	4.87E-08	4.85E-08	4.83E-08	4.81E-08	4.79E-08	4.77E-08
127900	1.42E-08	1.40E-08	1.38E-08	1.36E-08	1.34E-08	1.32E-08	1.30E-08	1.28E-08	1.26E-08	1.24E-08	1.22E-08
130000	6.07E-08	6.05E-08	6.03E-08	6.01E-08	5.99E-08	5.97E-08	5.95E-08	5.93E-08	5.91E-08	5.89E-08	5.87E-08
142100	1.19E-08	1.17E-08	1.15E-08	1.13E-08	1.11E-08	1.09E-08	1.07E-08	1.05E-08	1.03E-08	1.01E-08	9.99E-08
213000	3.44E-13	3.42E-13	3.40E-13	3.38E-13	3.36E-13	3.34E-13	3.32E-13	3.30E-13	3.28E-13	3.26E-13	3.24E-13
222000	1.46E-13	1.44E-13	1.42E-13	1.40E-13	1.38E-13	1.36E-13	1.34E-13	1.32E-13	1.30E-13	1.28E-13	1.26E-13
230000	3.09E-16	3.07E-16	3.05E-16	3.03E-16	3.01E-16	2.99E-16	2.97E-16	2.95E-16	2.93E-16	2.91E-16	2.89E-16
240000	1.23E-16	1.21E-16	1.19E-16	1.17E-16	1.15E-16	1.13E-16	1.11E-16	1.09E-16	1.07E-16	1.05E-16	1.03E-16
250000	6.02E-16	5.99E-16	5.96E-16	5.93E-16	5.90E-16	5.87E-16	5.84E-16	5.81E-16	5.78E-16	5.75E-16	5.72E-16
270000	2.74E-19	2.72E-19	2.70E-19	2.68E-19	2.66E-19	2.64E-19	2.62E-19	2.60E-19	2.58E-19	2.56E-19	2.54E-19
300000	1.00E-19	9.98E-19	9.96E-19	9.94E-19	9.92E-19	9.90E-19	9.88E-19	9.86E-19	9.84E-19	9.82E-19	9.80E-19
310000	7.48E-20	7.46E-20	7.44E-20	7.42E-20	7.40E-20	7.38E-20	7.36E-20	7.34E-20	7.32E-20	7.30E-20	7.28E-20
400000	2.74E-26	2.72E-26	2.70E-26	2.68E-26	2.66E-26	2.64E-26	2.62E-26	2.60E-26	2.58E-26	2.56E-26	2.54E-26
410000	1.09E-26	1.07E-26	1.05E-26	1.03E-26	1.01E-26	9.99E-26	9.97E-26	9.95E-26	9.93E-26	9.91E-26	9.89E-26

TABLE 49 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O

LEVEL (CR-1)	TEMPERATURE (DEG K)									
	24000	26000	32000	36000	40000	44000	48000	52000	56000	60000
0	4.14E-01	3.57E-01	2.94E-01	2.34E-01	1.65E-01	1.47E-01	1.18E-01	0.	0.	0.
150	2.44E-01	2.12E-01	1.79E-01	1.46E-01	1.11E-01	9.76E-02	7.63E-02	0.	0.	0.
226	6.14E-02	5.09E-02	4.01E-02	3.07E-02	2.37E-02	2.01E-02	1.54E-02	0.	0.	0.
15000	1.44E-01	1.24E-01	1.04E-01	8.44E-02	6.44E-02	5.44E-02	4.44E-02	0.	0.	0.
33792	1.89E-02	1.24E-02	1.20E-02	1.21E-02	1.10E-02	9.73E-03	8.55E-03	0.	0.	0.
126304	3.87E-04	9.73E-04	1.01E-03	2.71E-03	3.55E-03	4.25E-03	4.81E-03	0.	0.	0.
189337	2.87E-06	1.24E-05	3.44E-05	7.13E-05	1.26E-04	1.77E-04	2.30E-04	0.	0.	0.
277000	5.86E-09	4.97E-08	2.29E-07	7.30E-07	1.74E-06	3.42E-06	5.83E-06	0.	0.	0.
74903	7.42E-03	1.22E-02	1.67E-02	1.84E-02	2.00E-02	2.03E-02	1.94E-02	0.	0.	0.
87379	1.09E-02	1.92E-02	2.77E-02	3.42E-02	3.94E-02	4.09E-02	4.12E-02	0.	0.	0.
97443	9.61E-03	1.91E-02	2.94E-02	3.82E-02	4.55E-02	4.89E-02	5.00E-02	0.	0.	0.
95757	2.13E-03	4.14E-03	6.34E-03	8.17E-03	9.44E-03	1.03E-02	1.07E-02	0.	0.	0.
99314	5.15E-03	1.04E-02	1.62E-02	2.13E-02	2.50E-02	2.74E-02	2.80E-02	0.	0.	0.
102900	2.01E-02	4.10E-02	6.67E-02	8.90E-02	1.04E-01	1.10E-01	1.23E-01	0.	0.	0.
101323	3.74E-03	7.74E-03	1.22E-02	1.42E-02	1.62E-02	1.73E-02	1.79E-02	0.	0.	0.
113409	5.47E-03	1.23E-02	2.13E-02	3.00E-02	3.74E-02	4.29E-02	4.60E-02	0.	0.	0.
123040	4.91E-03	1.22E-02	2.23E-02	3.31E-02	4.24E-02	4.90E-02	5.17E-02	0.	0.	0.
120700	1.14E-02	3.04E-02	5.74E-02	8.74E-02	1.14E-01	1.40E-01	1.59E-01	0.	0.	0.
114416	1.04E-03	2.39E-03	4.11E-03	5.81E-03	7.24E-03	8.34E-03	9.15E-03	0.	0.	0.
127900	1.39E-03	3.59E-03	6.72E-03	1.02E-02	1.34E-02	1.61E-02	1.83E-02	0.	0.	0.
130000	1.27E-03	3.54E-03	7.11E-03	1.13E-02	1.55E-02	1.92E-02	2.24E-02	0.	0.	0.
142100	3.17E-03	9.23E-03	1.69E-02	3.00E-02	4.24E-02	5.41E-02	6.39E-02	0.	0.	0.
212000	5.40E-05	2.84E-04	9.19E-04	2.12E-03	3.90E-03	5.19E-03	6.84E-03	0.	0.	0.
222000	5.27E-05	3.04E-04	1.04E-03	2.52E-03	4.94E-03	7.93E-03	1.14E-02	0.	0.	0.
250000	2.04E-06	2.24E-05	9.40E-05	2.81E-04	6.22E-04	1.19E-03	1.84E-03	0.	0.	0.
260000	2.79E-06	2.39E-05	1.10E-04	3.39E-04	7.72E-04	1.47E-03	2.44E-03	0.	0.	0.
297000	1.00E-07	1.01E-06	5.24E-06	1.74E-05	4.30E-05	8.00E-05	1.54E-04	0.	0.	0.
290000	9.23E-08	1.02E-06	5.70E-06	2.82E-05	5.25E-05	1.10E-04	1.94E-04	0.	0.	0.
304000	1.09E-07	1.27E-06	7.34E-06	2.40E-05	7.13E-05	1.53E-04	2.80E-04	0.	0.	0.
314000	1.04E-07	1.39E-06	8.33E-06	3.19E-05	8.93E-05	1.94E-04	3.69E-04	0.	0.	0.
409000	2.01E-10	5.74E-09	4.94E-08	4.83E-07	1.63E-06	4.93E-06	1.20E-05	0.	0.	0.
419000	1.94E-10	6.11E-09	7.42E-08	4.81E-07	2.03E-06	6.32E-06	1.59E-05	0.	0.	0.

TABLE 50. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR

STATE	LEVEL (CM-1)	LEVEL (EV)	STAT. WT.	TEMPERATURE (DEG K)									
				1200	1400	1600	1800	2000	2400	2800	3200	3600	4000
$3s^1 3p^1$ ( $^1P^o$ )	0	0.	1	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09
	114094	16.2397	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	95188	11.0815	4	0.	2.60E-37	7.39E-35	2.50E-29	2.61E-25	2.50E-21	2.32E-19	2.20E-17	2.07E-15	1.95E-13
	107421	13.3182	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	120721	16.9671	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
$3s^1 3p^1$ ( $^3P^o$ )	0	0.	3	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09
	121654	15.0426	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	112949	16.0034	40	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	95371	11.5762	0	0.	2.74E-34	7.39E-35	2.50E-29	2.61E-25	2.50E-21	2.32E-19	2.20E-17	2.07E-15	1.95E-13
	109631	13.0942	24	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
$3s^1 3p^1$ ( $^3S$ )	0	0.	40	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09
	120222	16.9671	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	222000	21.3236	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	203000	25.1641	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	215000	26.6379	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
$3s^1 3p^1$ ( $^1D^o$ )	0	0.	20	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-09
	120222	16.9671	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	222000	21.3236	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	203000	25.1641	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	215000	26.6379	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949), BURNS AND MOORE (1953), AND HUMPHREYS AND PAUL (1959)

TABLE 50 (CONT.1). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ar

LEVEL (C-1)	TEMPERATURE (DEG K)									
	9400	10000	11000	12000	13000	14000	15000	16000	17000	18000
0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	9.99E-01	9.97E-01	9.95E-01	9.90E-01	9.82E-01	9.70E-01
114854	6.49E-07	1.33E-06	5.76E-06	2.89E-05	6.33E-05	1.49E-04	3.27E-04	6.47E-04	1.18E-03	2.00E-03
93188	2.55E-06	4.51E-06	1.37E-05	4.42E-05	1.08E-04	2.23E-04	4.31E-04	7.59E-04	1.23E-03	1.93E-03
107421	1.22E-06	2.33E-06	9.49E-06	3.06E-05	8.23E-05	1.92E-04	4.00E-04	7.38E-04	1.23E-03	2.17E-03
120721	2.78E-07	5.72E-07	2.78E-06	1.03E-05	3.13E-05	1.06E-04	2.60E-04	5.02E-04	7.10E-04	1.23E-03
121654	3.38E-07	7.01E-07	3.44E-06	1.29E-05	3.97E-05	1.04E-04	2.30E-04	4.92E-04	9.20E-04	1.63E-03
112948	1.78E-06	3.50E-06	1.53E-05	5.25E-05	1.49E-04	3.63E-04	7.95E-04	1.54E-03	2.77E-03	4.64E-03
93371	6.49E-06	1.17E-05	3.97E-05	1.10E-04	2.60E-04	5.43E-04	1.03E-03	1.79E-03	2.91E-03	4.49E-03
109431	3.20E-06	6.02E-06	2.48E-05	7.50E-05	2.01E-04	4.62E-04	9.30E-04	1.70E-03	3.09E-03	5.01E-03
119211	6.46E-07	1.42E-06	6.76E-06	2.40E-05	7.44E-05	1.91E-04	4.30E-04	8.75E-04	1.63E-03	2.82E-03
120222	8.36E-07	1.72E-06	8.30E-06	3.00E-05	9.31E-05	2.41E-04	5.47E-04	1.12E-03	2.10E-03	3.62E-03
222000	7.10E-14	2.69E-13	4.90E-12	5.51E-11	4.26E-10	2.44E-09	1.12E-08	6.23E-08	3.14E-07	9.54E-07
203000	2.45E-13	8.27E-13	1.18E-11	1.07E-10	4.99E-10	3.47E-09	1.39E-08	6.47E-08	3.14E-07	8.09E-07
215000	1.22E-13	4.41E-13	7.34E-12	7.65E-11	5.55E-10	3.63E-09	1.37E-08	6.77E-08	3.14E-07	8.09E-07
227900	2.93E-14	1.15E-13	2.26E-12	2.71E-11	2.22E-10	1.54E-09	6.36E-09	2.49E-08	8.25E-08	2.38E-07
228900	3.53E-14	1.39E-13	2.76E-12	3.37E-11	2.78E-10	1.70E-09	8.12E-09	3.10E-08	1.04E-07	3.80E-07
229900	3.53E-14	1.39E-13	2.76E-12	3.37E-11	2.78E-10	1.70E-09	8.12E-09	3.10E-08	1.04E-07	3.80E-07

LEVEL (C-1)	TEMPERATURE (DEG K)									
	24000	28000	32000	36000	40000	44000	48000	0	0	0
0	7.83E-01	5.80E-01	4.01E-01	2.74E-01	1.95E-01	1.43E-01	1.06E-01	0.	0.	0.
114854	1.49E-02	3.17E-02	4.99E-02	5.60E-02	6.25E-02	6.67E-02	6.94E-02	0.	0.	0.
93188	1.04E-02	1.74E-02	2.22E-02	2.44E-02	2.54E-02	2.54E-02	2.54E-02	0.	0.	0.
107421	1.50E-02	2.79E-02	3.89E-02	4.32E-02	4.90E-02	5.10E-02	5.20E-02	0.	0.	0.
120721	1.13E-02	2.33E-02	3.53E-02	4.33E-02	5.04E-02	5.50E-02	5.82E-02	0.	0.	0.
121654	1.49E-02	3.13E-02	4.73E-02	5.97E-02	6.85E-02	7.40E-02	7.82E-02	0.	0.	0.
112948	3.90E-02	7.00E-02	1.00E-01	1.21E-01	1.34E-01	1.42E-01	1.47E-01	0.	0.	0.
93371	2.32E-02	3.93E-02	4.82E-02	5.20E-02	5.42E-02	5.59E-02	5.72E-02	0.	0.	0.
109431	3.34E-02	6.12E-02	8.34E-02	9.71E-02	1.05E-01	1.08E-01	1.10E-01	0.	0.	0.
119211	2.47E-02	5.07E-02	7.59E-02	9.41E-02	1.07E-01	1.10E-01	1.12E-01	0.	0.	0.
120222	3.23E-02	6.74E-02	1.01E-01	1.24E-01	1.44E-01	1.57E-01	1.62E-01	0.	0.	0.
222000	2.40E-05	1.29E-04	3.71E-04	7.73E-04	1.33E-03	2.01E-03	2.79E-03	0.	0.	0.
203000	1.62E-05	8.84E-05	1.74E-04	3.36E-04	5.25E-04	7.47E-04	9.86E-04	0.	0.	0.
215000	2.37E-05	1.11E-04	3.02E-04	6.14E-04	1.02E-03	1.51E-03	2.07E-03	0.	0.	0.
227900	1.82E-05	9.52E-05	2.65E-04	6.11E-04	1.07E-03	1.60E-03	2.34E-03	0.	0.	0.
228900	2.41E-05	1.27E-04	3.81E-04	8.22E-04	1.45E-03	2.24E-03	3.18E-03	0.	0.	0.

TABLE 51. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C<sup>+</sup>

STATE	LEVEL (CM <sup>-1</sup> )	STAT.	TEMPERATURE (DEG K)									
			1200	1600	2000	2400	2800	3200	3600	4000	4400	
2s <sup>2</sup> 2p <sup>2</sup> P <sup>2</sup> <sub>3/2</sub>	0	2	3.51E-01	3.44E-01	3.44E-01	3.42E-01	3.41E-01	3.40E-01	3.39E-01	3.38E-01	3.38E-01	
	64	4	6.49E-01	6.54E-01	6.54E-01	6.54E-01	6.54E-01	6.40E-01	6.41E-01	6.42E-01	6.42E-01	
	43033	12	8.22E-23	3.25E-17	7.40E-14	1.28E-11	5.09E-10	8.04E-09	6.90E-08	3.89E-07	1.57E-06	
	79322	10	0.	9.43E-30	6.67E-24	5.29E-20	3.23E-17	3.97E-15	1.67E-13	3.33E-12	3.84E-11	
	94494	2	0.	7.16E-39	2.45E-31	2.45E-26	9.66E-23	4.89E-20	6.05E-18	2.84E-16	6.69E-15	
2s <sup>2</sup> 2p <sup>2</sup> P <sup>2</sup> <sub>1/2</sub>	110653	6	0.	0.	2.77E-35	1.59E-29	2.07E-25	2.52E-22	6.33E-20	5.24E-18	1.94E-16	
	142024	4	0.	0.	0.	7.21E-38	1.38E-32	1.25E-28	1.51E-25	4.41E-23	4.58E-21	
	150465	10	0.	0.	0.	0.	4.50E-34	7.04E-30	1.90E-26	5.29E-24	7.24E-22	
	168744	6	0.	0.	0.	0.	2.25E-36	1.14E-33	5.23E-30	4.43E-27	1.10E-24	
	116538	2	0.	0.	1.34E-37	1.54E-31	3.35E-27	5.94E-24	2.01E-21	2.11E-19	9.53E-18	
2s <sup>2</sup> (5)	131725	6	0.	0.	0.	5.17E-35	4.10E-30	1.93E-26	1.39E-23	2.69E-21	1.99E-19	
	145550	10	0.	0.	0.	2.18E-38	5.62E-33	6.44E-29	9.24E-26	3.10E-23	3.61E-21	
	157235	2	0.	0.	0.	0.	2.77E-36	6.73E-32	1.73E-28	9.27E-26	1.54E-23	
	142523	6	0.	0.	0.	0.	5.50E-37	1.57E-32	6.28E-29	4.15E-26	8.43E-24	
	168125	10	0.	0.	0.	0.	5.15E-38	2.52E-33	1.12E-29	9.22E-27	2.23E-24	
2s <sup>2</sup> 2p <sup>1</sup> (P <sup>1</sup> )	148979	14	0.	0.	0.	0.	4.65E-38	2.60E-33	1.11E-29	9.50E-27	2.30E-24	
	170443	12	0.	0.	0.	0.	2.54E-38	1.64E-33	7.34E-30	6.71E-27	1.72E-24	
	184786	50	0.	0.	0.	0.	0.	7.38E-36	7.73E-32	1.24E-28	5.23E-26	
	197742	90	0.	0.	0.	0.	0.	7.28E-34	1.94E-30	1.24E-27	1.24E-26	
	210000**	18	0.	0.	0.	0.	0.	0.	1.08E-36	4.77E-33	4.57E-30	
2s <sup>2</sup> 2p <sup>1</sup> (P <sup>1</sup> )	215730**	54	0.	0.	0.	0.	0.	0.	3.29E-37	1.82E-33	2.11E-30	
	220445	90	0.	0.	0.	0.	0.	0.	0.	5.53E-34	7.47E-31	
	221458	126	0.	0.	0.	0.	0.	0.	0.	5.42E-34	7.54E-31	
	219000*	4	0.	0.	0.	0.	0.	0.	9.89E-39	6.25E-35	8.04E-32	
	234000*	18	0.	0.	0.	0.	0.	0.	0.	5.50E-37	1.79E-33	
2s <sup>2</sup> 2p <sup>1</sup> (P <sup>1</sup> )	244000*	30	0.	0.	0.	0.	0.	0.	0.	0.	5.88E-35	
	246000*	6	0.	0.	0.	0.	0.	0.	0.	0.	1.21E-27	
	245000*	18	0.	0.	0.	0.	0.	0.	0.	0.	7.07E-38	
	270500*	30	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	271400*	42	0.	0.	0.	0.	0.	0.	0.	0.	0.	
2s <sup>2</sup> 2p <sup>1</sup> (D)	257000*	18	0.	0.	0.	0.	0.	0.	0.	0.	9.48E-37	
	271000*	54	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	281000*	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	292000*	50	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	313000*	140	0.	0.	0.	0.	0.	0.	0.	0.	0.	
2s <sup>2</sup> 2p <sup>1</sup> (S)	319000*	14	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	349000*	32	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	351000*	32	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	352000*	32	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	353000*	32	0.	0.	0.	0.	0.	0.	0.	0.	0.	

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
MONITORING ENERGY LEVELS FROM MOORE (1949) AND GLAD (1954)

TABLE 51 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C<sup>+</sup>

LEVEL (C <sub>II</sub> -1)	TEMPERATURE (DEG K)											
	4000	5200	5600	6000	6400	6800	7200	7600	8000	8400	8800	9200
C	3.38E-01	3.37E-01	3.37E-01	3.37E-01	3.36E-01	3.36E-01	3.35E-01	3.34E-01	3.34E-01	3.33E-01	3.33E-01	3.33E-01
64	6.82E-01	6.83E-01	6.83E-01	6.83E-01	6.82E-01	6.82E-01	6.81E-01	6.81E-01	6.81E-01	6.80E-01	6.80E-01	6.80E-01
43033	5.04E-05	1.34E-05	6.67E-05	1.34E-05	6.67E-05	1.34E-05	6.67E-05	1.34E-05	6.67E-05	1.34E-05	6.67E-05	1.34E-05
74932	2.97E-10	1.67E-09	7.34E-09	2.65E-08	1.33E-08	6.13E-08	2.98E-07	1.16E-06	4.47E-06	1.64E-05	6.01E-05	2.18E-04
94494	9.27E-14	6.57E-13	5.74E-12	5.01E-11	1.28E-10	4.57E-10	1.42E-09	3.11E-09	7.92E-09	2.23E-08	4.71E-08	9.33E-08
110453	3.99E-15	5.11E-14	4.55E-13	3.02E-12	1.59E-11	6.89E-11	2.51E-10	8.95E-10	2.29E-09	5.91E-09	1.40E-08	3.84E-08
142024	2.19E-19	5.70E-18	9.50E-17	1.09E-15	9.13E-15	9.90E-14	3.10E-13	1.41E-12	5.82E-12	1.83E-11	5.91E-11	1.51E-10
150465	4.37E-20	1.40E-18	2.74E-17	3.60E-16	1.47E-15	1.47E-14	1.47E-13	7.15E-13	1.00E-12	1.00E-11	3.47E-11	1.01E-10
167734	1.09E-22	3.39E-21	1.50E-19	2.70E-18	3.38E-17	1.03E-16	2.29E-15	1.35E-14	6.82E-14	2.82E-13	1.09E-12	3.47E-12
116530	2.28E-16	3.34E-15	2.44E-14	2.44E-13	1.41E-12	6.50E-12	2.59E-11	8.00E-11	2.65E-10	7.19E-10	1.70E-09	4.07E-09
131725	7.21E-18	1.50E-16	2.03E-15	1.93E-14	1.39E-13	7.93E-13	3.73E-12	1.49E-11	5.10E-11	1.60E-10	4.44E-10	1.14E-09
144550	1.09E-19	5.40E-18	9.40E-17	1.17E-15	1.04E-14	7.09E-14	3.92E-13	1.81E-12	7.10E-12	2.50E-11	7.79E-11	2.18E-10
157235	1.15E-21	4.30E-20	9.42E-19	1.42E-17	1.50E-16	1.20E-15	7.40E-15	3.97E-14	1.74E-13	6.79E-13	2.79E-12	7.01E-12
162523	7.05E-22	2.99E-20	7.42E-19	1.20E-17	1.37E-16	1.17E-15	7.92E-15	4.37E-14	2.04E-13	8.15E-13	2.90E-12	9.19E-12
168125	2.19E-22	1.04E-20	2.93E-19	5.21E-18	6.47E-17	5.98E-16	4.31E-15	2.52E-14	1.24E-13	5.22E-13	1.93E-12	6.20E-12
148979	2.38E-22	1.17E-20	3.29E-19	5.95E-18	7.48E-17	6.90E-16	5.09E-15	3.01E-14	1.49E-13	6.32E-13	2.35E-12	7.01E-12
170443	1.04E-22	9.40E-21	2.74E-19	5.13E-18	6.42E-17	6.32E-16	4.60E-15	2.82E-14	1.42E-13	6.11E-13	2.30E-12	7.74E-12
184788	8.01E-24	5.40E-22	2.19E-20	5.18E-19	8.24E-18	9.50E-17	8.34E-16	5.82E-15	3.34E-14	1.63E-13	6.80E-13	2.54E-12
197742	2.75E-25	2.45E-23	1.31E-21	3.84E-20	7.48E-19	1.02E-17	1.04E-16	6.34E-16	3.42E-15	2.95E-14	1.31E-13	5.59E-13
210000	1.40E-27	1.77E-25	1.12E-23	4.09E-22	9.51E-21	1.53E-19	1.80E-18	1.44E-17	1.20E-16	7.22E-16	3.70E-15	1.64E-14
213730	7.52E-28	1.09E-25	7.72E-24	3.10E-22	7.87E-21	1.34E-19	1.72E-18	1.64E-17	1.28E-16	8.11E-16	4.39E-15	2.01E-14
220445	3.03E-28	4.89E-26	3.81E-24	1.64E-22	4.52E-21	6.34E-20	1.11E-18	1.13E-17	9.10E-17	6.01E-16	3.34E-15	1.60E-14
221458	3.15E-28	5.20E-26	4.13E-24	1.83E-22	5.04E-21	7.44E-20	1.20E-18	1.31E-17	1.07E-16	7.10E-16	3.90E-15	1.92E-14
219000	3.14E-29	4.89E-27	3.70E-25	1.57E-23	4.19E-22	7.50E-21	9.94E-20	5.94E-19	7.90E-18	5.15E-17	2.83E-16	1.34E-15
234000	1.05E-30	2.31E-28	2.35E-26	1.29E-24	4.31E-23	9.52E-22	1.49E-20	1.74E-19	1.40E-18	1.10E-17	7.31E-17	3.05E-16
244000	4.79E-32	1.30E-29	1.80E-27	1.21E-25	4.84E-24	1.25E-22	2.24E-21	3.00E-20	3.07E-19	2.52E-18	1.71E-17	9.83E-17
240000	1.44E-34	5.79E-32	9.89E-30	8.44E-28	4.16E-26	1.29E-24	2.79E-23	4.23E-22	4.95E-21	4.59E-20	3.47E-19	2.28E-18
265000	9.47E-35	4.39E-32	8.18E-30	7.65E-28	3.04E-26	1.39E-24	3.04E-23	4.93E-22	6.05E-21	5.89E-20	4.60E-19	3.02E-18
270500	3.10E-35	1.59E-32	3.32E-30	3.41E-28	1.94E-26	7.02E-25	1.69E-23	2.90E-22	3.75E-21	3.00E-20	3.12E-19	2.19E-18
271400	3.31E-35	1.73E-32	3.69E-30	3.89E-28	2.25E-26	8.12E-25	1.97E-23	3.42E-22	4.46E-21	4.54E-20	3.77E-19	2.59E-18
257000	1.04E-33	3.90E-31	6.39E-29	5.21E-27	2.45E-25	7.33E-24	1.50E-22	2.24E-21	2.58E-20	2.30E-19	1.70E-18	1.04E-17
271000	4.80E-35	2.40E-32	5.29E-30	5.44E-28	3.14E-26	1.14E-24	2.79E-23	4.79E-22	6.17E-21	6.20E-20	5.17E-19	3.59E-18
283000	2.19E-34	1.49E-33	4.01E-31	5.11E-29	1.50E-27	4.14E-26	8.14E-25	1.19E-24	1.14E-23	1.14E-22	1.21E-21	9.69E-20
304500	0.	1.25E-35	5.12E-33	9.42E-31	9.01E-29	5.04E-27	1.81E-25	4.44E-24	7.95E-23	1.60E-22	1.15E-21	1.60E-20
267000	2.91E-35	1.39E-32	2.72E-30	2.63E-28	1.44E-26	4.91E-25	1.13E-23	1.87E-22	2.34E-21	2.31E-20	1.84E-19	1.23E-18
281000	1.13E-34	8.64E-34	2.23E-31	2.79E-29	1.95E-27	7.41E-26	2.07E-24	3.97E-23	5.47E-22	6.20E-21	5.60E-20	4.13E-19
293000	8.21E-38	6.80E-35	2.21E-32	3.20E-30	2.40E-28	1.24E-26	3.84E-25	2.20E-24	1.31E-22	1.50E-21	1.50E-20	1.23E-19
315000	0.	6.80E-37	3.20E-34	4.82E-32	7.42E-30	4.45E-28	4.95E-26	4.95E-25	9.50E-24	1.40E-23	1.40E-22	1.40E-21
319000	0.	0.	7.71E-36	1.82E-33	2.17E-31	1.47E-29	6.29E-28	1.70E-26	3.58E-25	5.43E-24	6.73E-23	4.50E-22
349000	0.	0.	0.	2.53E-38	4.54E-34	4.50E-32	2.77E-30	1.09E-28	2.95E-27	5.80E-26	8.67E-25	1.60E-23



TABLE 51 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C<sup>+</sup>

LEVEL (CM-1)	TEMPERATURE (DEG K)											
	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000	19000	20000
0	3.34E-01	3.34E-01	3.33E-01	3.31E-01	3.29E-01	3.27E-01	3.24E-01	3.21E-01	3.17E-01	3.13E-01	3.09E-01	3.04E-01
64	6.82E-01	6.82E-01	6.80E-01	6.77E-01	6.74E-01	6.69E-01	6.64E-01	6.57E-01	6.50E-01	6.42E-01	6.34E-01	6.26E-01
43033	3.17E-03	3.17E-03	3.17E-03	3.16E-03	3.15E-03	3.14E-03	3.13E-03	3.12E-03	3.11E-03	3.10E-03	3.09E-03	3.08E-03
74932	2.22E-05	2.22E-05	2.22E-05	2.21E-05	2.20E-05	2.19E-05	2.18E-05	2.17E-05	2.16E-05	2.15E-05	2.14E-05	2.13E-05
96494	1.75E-07	1.75E-07	1.75E-07	1.74E-07	1.73E-07	1.72E-07	1.71E-07	1.70E-07	1.69E-07	1.68E-07	1.67E-07	1.66E-07
110453	4.30E-08	4.30E-08	4.29E-08	4.28E-08	4.27E-08	4.26E-08	4.25E-08	4.24E-08	4.23E-08	4.22E-08	4.21E-08	4.20E-08
142024	3.81E-10	3.81E-10	3.80E-10	3.79E-10	3.78E-10	3.77E-10	3.76E-10	3.75E-10	3.74E-10	3.73E-10	3.72E-10	3.71E-10
150445	2.69E-10	2.69E-10	2.68E-10	2.67E-10	2.66E-10	2.65E-10	2.64E-10	2.63E-10	2.62E-10	2.61E-10	2.60E-10	2.59E-10
160744	1.04E-11	1.04E-11	1.03E-11	1.02E-11	1.01E-11	1.00E-11	9.99E-12	9.98E-12	9.97E-12	9.96E-12	9.95E-12	9.94E-12
116330	8.69E-09	8.69E-09	8.68E-09	8.67E-09	8.66E-09	8.65E-09	8.64E-09	8.63E-09	8.62E-09	8.61E-09	8.60E-09	8.59E-09
131725	2.66E-09	2.66E-09	2.65E-09	2.64E-09	2.63E-09	2.62E-09	2.61E-09	2.60E-09	2.59E-09	2.58E-09	2.57E-09	2.56E-09
145550	5.62E-10	5.62E-10	5.61E-10	5.60E-10	5.59E-10	5.58E-10	5.57E-10	5.56E-10	5.55E-10	5.54E-10	5.53E-10	5.52E-10
157235	1.95E-11	1.95E-11	1.94E-11	1.93E-11	1.92E-11	1.91E-11	1.90E-11	1.89E-11	1.88E-11	1.87E-11	1.86E-11	1.85E-11
162523	2.65E-11	2.65E-11	2.64E-11	2.63E-11	2.62E-11	2.61E-11	2.60E-11	2.59E-11	2.58E-11	2.57E-11	2.56E-11	2.55E-11
168123	1.91E-11	1.91E-11	1.90E-11	1.89E-11	1.88E-11	1.87E-11	1.86E-11	1.85E-11	1.84E-11	1.83E-11	1.82E-11	1.81E-11
168979	2.35E-11	2.35E-11	2.34E-11	2.33E-11	2.32E-11	2.31E-11	2.30E-11	2.29E-11	2.28E-11	2.27E-11	2.26E-11	2.25E-11
170443	3.35E-11	3.35E-11	3.34E-11	3.33E-11	3.32E-11	3.31E-11	3.30E-11	3.29E-11	3.28E-11	3.27E-11	3.26E-11	3.25E-11
184784	8.47E-12	8.47E-12	8.46E-12	8.45E-12	8.44E-12	8.43E-12	8.42E-12	8.41E-12	8.40E-12	8.39E-12	8.38E-12	8.37E-12
197742	2.03E-12	2.03E-12	2.02E-12	2.01E-12	2.00E-12	1.99E-12	1.98E-12	1.97E-12	1.96E-12	1.95E-12	1.94E-12	1.93E-12
210000	6.49E-16	6.49E-16	6.48E-16	6.47E-16	6.46E-16	6.45E-16	6.44E-16	6.43E-16	6.42E-16	6.41E-16	6.40E-16	6.39E-16
215730	8.20E-16	8.20E-16	8.19E-16	8.18E-16	8.17E-16	8.16E-16	8.15E-16	8.14E-16	8.13E-16	8.12E-16	8.11E-16	8.10E-16
220465	6.72E-16	6.72E-16	6.71E-16	6.70E-16	6.69E-16	6.68E-16	6.67E-16	6.66E-16	6.65E-16	6.64E-16	6.63E-16	6.62E-16
221450	8.11E-16	8.11E-16	8.10E-16	8.09E-16	8.08E-16	8.07E-16	8.06E-16	8.05E-16	8.04E-16	8.03E-16	8.02E-16	8.01E-16
221900	5.50E-16	5.50E-16	5.49E-16	5.48E-16	5.47E-16	5.46E-16	5.45E-16	5.44E-16	5.43E-16	5.42E-16	5.41E-16	5.40E-16
234000	1.77E-15	1.77E-15	1.76E-15	1.75E-15	1.74E-15	1.73E-15	1.72E-15	1.71E-15	1.70E-15	1.69E-15	1.68E-15	1.67E-15
246000	4.88E-16	4.88E-16	4.87E-16	4.86E-16	4.85E-16	4.84E-16	4.83E-16	4.82E-16	4.81E-16	4.80E-16	4.79E-16	4.78E-16
260000	1.20E-17	1.20E-17	1.19E-17	1.18E-17	1.17E-17	1.16E-17	1.15E-17	1.14E-17	1.13E-17	1.12E-17	1.11E-17	1.10E-17
265000	1.70E-17	1.70E-17	1.69E-17	1.68E-17	1.67E-17	1.66E-17	1.65E-17	1.64E-17	1.63E-17	1.62E-17	1.61E-17	1.60E-17
270500	1.24E-17	1.24E-17	1.23E-17	1.22E-17	1.21E-17	1.20E-17	1.19E-17	1.18E-17	1.17E-17	1.16E-17	1.15E-17	1.14E-17
271400	1.52E-17	1.52E-17	1.51E-17	1.50E-17	1.49E-17	1.48E-17	1.47E-17	1.46E-17	1.45E-17	1.44E-17	1.43E-17	1.42E-17
257000	5.43E-17	5.43E-17	5.42E-17	5.41E-17	5.40E-17	5.39E-17	5.38E-17	5.37E-17	5.36E-17	5.35E-17	5.34E-17	5.33E-17
271000	2.07E-17	2.07E-17	2.06E-17	2.05E-17	2.04E-17	2.03E-17	2.02E-17	2.01E-17	2.00E-17	1.99E-17	1.98E-17	1.97E-17
283000	5.72E-18	5.72E-18	5.71E-18	5.70E-18	5.69E-18	5.68E-18	5.67E-18	5.66E-18	5.65E-18	5.64E-18	5.63E-18	5.62E-18
304500	7.29E-19	7.29E-19	7.28E-19	7.27E-19	7.26E-19	7.25E-19	7.24E-19	7.23E-19	7.22E-19	7.21E-19	7.20E-19	7.19E-19
267000	6.94E-18	6.94E-18	6.93E-18	6.92E-18	6.91E-18	6.90E-18	6.89E-18	6.88E-18	6.87E-18	6.86E-18	6.85E-18	6.84E-18
281000	2.57E-18	2.57E-18	2.56E-18	2.55E-18	2.54E-18	2.53E-18	2.52E-18	2.51E-18	2.50E-18	2.49E-18	2.48E-18	2.47E-18
292000	6.24E-19	6.24E-19	6.23E-19	6.22E-19	6.21E-19	6.20E-19	6.19E-19	6.18E-19	6.17E-19	6.16E-19	6.15E-19	6.14E-19
313000	1.13E-19	1.13E-19	1.12E-19	1.11E-19	1.10E-19	1.09E-19	1.08E-19	1.07E-19	1.06E-19	1.05E-19	1.04E-19	1.03E-19
319000	5.19E-21	5.19E-21	5.18E-21	5.17E-21	5.16E-21	5.15E-21	5.14E-21	5.13E-21	5.12E-21	5.11E-21	5.10E-21	5.09E-21
349000	1.03E-22	1.03E-22	1.02E-22	1.01E-22	1.00E-22	9.99E-23	9.98E-23	9.97E-23	9.96E-23	9.95E-23	9.94E-23	9.93E-23

TABLE 51 (CONT.-1). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C+

LEVEL	TEMPERATURE (DEG K)									
	10000	20000	32000	40000	44000	48000	0	0	0	0
1C4-11	0	2.64E-01	2.63E-01	2.42E-01	2.00E-01	1.79E-01	0.	0.	0.	0.
44	5.67E-01	5.25E-01	4.82E-01	4.40E-01	3.94E-01	3.57E-01	0.	0.	0.	0.
43031	1.79E-01	1.74E-01	2.10E-01	2.37E-01	2.55E-01	2.63E-01	0.	0.	0.	0.
74322	1.59E-02	2.80E-02	4.16E-02	5.52E-02	6.74E-02	7.73E-02	0.	0.	0.	0.
90494	8.74E-04	1.89E-03	3.16E-03	4.67E-03	6.21E-03	7.63E-03	0.	0.	0.	0.
110453	1.12E-03	2.69E-03	5.01E-03	7.95E-03	1.12E-02	1.44E-02	0.	0.	0.	0.
142024	1.16E-04	3.54E-04	8.16E-04	1.51E-03	2.41E-03	3.44E-03	0.	0.	0.	0.
150464	1.72E-04	5.78E-04	1.40E-03	2.70E-03	4.53E-03	6.76E-03	0.	0.	0.	0.
168744	3.48E-05	1.35E-04	3.68E-04	7.80E-04	1.38E-03	2.16E-03	0.	0.	0.	0.
116538	2.63E-04	6.60E-04	1.28E-03	2.09E-03	3.02E-03	3.94E-03	0.	0.	0.	0.
131725	3.17E-04	9.08E-04	1.94E-03	3.47E-03	5.24E-03	7.24E-03	0.	0.	0.	0.
145550	2.31E-04	7.44E-04	1.74E-03	3.21E-03	5.32E-03	7.87E-03	0.	0.	0.	0.
157235	2.29E-05	8.14E-05	2.04E-04	4.12E-04	6.98E-04	1.05E-03	0.	0.	0.	0.
162323	5.01E-05	1.87E-04	4.87E-04	1.04E-03	1.73E-03	2.64E-03	0.	0.	0.	0.
162125	5.97E-05	2.33E-04	6.31E-04	1.31E-03	2.34E-03	3.67E-03	0.	0.	0.	0.
168979	7.93E-05	3.12E-04	8.50E-04	1.84E-03	3.20E-03	4.94E-03	0.	0.	0.	0.
170443	9.23E-05	3.69E-04	1.01E-03	2.17E-03	3.88E-03	6.01E-03	0.	0.	0.	0.
184784	1.19E-04	5.39E-04	1.61E-03	3.70E-03	7.00E-03	1.15E-02	0.	0.	0.	0.
197742	9.89E-05	4.58E-04	1.50E-03	3.47E-03	7.32E-03	1.25E-02	0.	0.	0.	0.
210000	8.72E-06	4.88E-05	1.73E-04	4.56E-04	9.42E-04	1.66E-03	0.	0.	0.	0.
215730	1.84E-05	1.09E-04	4.00E-04	1.07E-03	2.30E-03	4.18E-03	0.	0.	0.	0.
220465	2.33E-05	1.42E-04	5.39E-04	1.44E-03	3.23E-03	5.96E-03	0.	0.	0.	0.
221458	3.07E-05	1.90E-04	7.22E-04	1.94E-03	4.37E-03	8.08E-03	0.	0.	0.	0.
219000	1.70E-06	1.02E-05	3.84E-05	1.05E-04	2.27E-04	4.17E-04	0.	0.	0.	0.
234000	2.07E-06	1.42E-05	5.87E-05	1.72E-04	3.97E-04	7.64E-04	0.	0.	0.	0.
244000	1.64E-06	1.24E-05	5.70E-05	1.78E-04	4.30E-04	8.42E-04	0.	0.	0.	0.
260000	1.43E-07	1.25E-06	9.08E-06	2.03E-05	5.20E-05	1.07E-04	0.	0.	0.	0.
265000	3.23E-07	2.89E-06	1.44E-05	4.99E-05	1.30E-04	2.78E-04	0.	0.	0.	0.
270500	3.87E-07	3.43E-06	1.90E-05	6.48E-05	1.70E-04	3.87E-04	0.	0.	0.	0.
271400	5.13E-07	4.85E-06	2.59E-05	9.02E-05	2.41E-04	5.24E-04	0.	0.	0.	0.
287000	5.21E-07	4.34E-06	2.09E-05	6.87E-05	1.74E-04	3.91E-04	0.	0.	0.	0.
271000	6.75E-07	6.37E-06	3.34E-05	1.18E-04	3.15E-04	6.65E-04	0.	0.	0.	0.
293000	5.48E-07	5.73E-06	3.24E-05	1.23E-04	3.41E-04	7.71E-04	0.	0.	0.	0.
304500	4.84E-07	6.07E-06	3.69E-05	1.45E-04	3.83E-04	1.22E-03	0.	0.	0.	0.
267000	1.59E-07	1.45E-06	7.40E-06	2.58E-05	6.73E-05	1.45E-04	0.	0.	0.	0.
281000	2.04E-07	2.12E-06	1.18E-05	4.39E-05	1.22E-04	2.75E-04	0.	0.	0.	0.
292000	1.78E-07	2.00E-06	1.23E-05	4.71E-05	1.37E-04	3.19E-04	0.	0.	0.	0.
313000	1.61E-07	2.18E-06	1.50E-05	6.52E-05	2.86E-04	5.14E-04	0.	0.	0.	0.
319000	1.27E-08	1.28E-06	5.77E-06	1.87E-05	4.87E-05	4.75E-05	0.	0.	0.	0.
349000	3.73E-09	6.84E-08	5.95E-07	3.89E-06	1.13E-05	3.17E-05	0.	0.	0.	0.

TABLE 52. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF P+

STATE	LEVEL (CM-1)	STAT. WT.	TEMPERATURE (DEG K)									
			1200	1600	2000	2400	2800	3200	3600	4000	4400	4800
2s 2p <sup>1</sup> P <sub>1</sub>	0	1	1.23E-01	1.20E-01	1.18E-01	1.17E-01	1.16E-01	1.16E-01	1.15E-01	1.14E-01	1.14E-01	1.14E-01
	48	3	3.49E-01	3.45E-01	3.43E-01	3.41E-01	3.40E-01	3.39E-01	3.38E-01	3.37E-01	3.36E-01	3.36E-01
	130	7	5.27E-01	5.24E-01	5.23E-01	5.22E-01	5.21E-01	5.20E-01	5.19E-01	5.18E-01	5.17E-01	5.17E-01
	15316	5	4.53E-09	6.27E-07	9.71E-06	6.03E-05	2.22E-04	5.90E-04	1.24E-03	2.32E-03	3.81E-03	5.44E-03
	32689	1	1.17E-18	2.04E-14	7.25E-12	3.61E-10	5.09E-09	4.70E-08	2.44E-07	8.96E-07	2.60E-06	7.40E-06
2s 2p <sup>3</sup> P <sub>2</sub>	44785	5	5.00E-05	3.22E-19	1.43E-15	3.06E-13	2.11E-11	4.23E-10	4.25E-09	2.01E-08	1.29E-07	8.00E-07
	92245	15	11.43E-06	1.70E-36	2.69E-29	1.69E-24	4.33E-21	1.60E-18	1.60E-16	6.60E-15	1.34E-13	2.60E-12
	109218	9	0.	0.	0.03E-35	3.67E-29	4.93E-25	4.90E-22	1.14E-19	6.94E-16	3.17E-14	1.40E-12
	158127	3	0.	0.	0.	0.	8.30E-34	1.73E-31	4.09E-28	2.01E-25	3.19E-23	5.00E-21
	144188	5	0.	0.	0.	1.69E-30	3.94E-33	4.04E-29	5.40E-26	1.71E-23	1.90E-21	2.60E-19
2p <sup>1</sup> P <sub>1</sub>	146766	3	0.	0.	0.	0.	2.12E-38	9.44E-34	3.91E-30	3.05E-27	7.09E-25	1.40E-23
	210000	9	0.	0.	0.	0.	0.	0.	1.50E-30	9.00E-29	1.13E-28	1.72E-27
	229000	5	0.	0.	0.	0.	0.	0.	0.	9.40E-37	1.72E-33	3.67E-30
	264000	1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	144056	12	0.	0.	0.	0.	7.60E-34	1.09E-29	1.05E-26	7.13E-24	9.29E-22	1.40E-20
2s 2p <sup>3</sup> P <sub>2</sub>	160022	36	0.	0.	0.	0.	7.90E-38	4.12E-33	1.90E-29	1.43E-26	4.07E-24	1.51E-22
	187093	60	0.	0.	0.	0.	0.	0.	1.82E-32	3.20E-29	1.51E-26	5.44E-24
	194955	12	0.	0.	0.	0.	0.	0.	6.99E-35	2.39E-31	1.44E-28	5.37E-26
	203304	36	0.	0.	0.	0.	0.	0.	2.07E-35	6.97E-32	5.37E-29	2.60E-26
	210284	50	0.	0.	0.	0.	0.	0.	2.10E-36	9.71E-33	9.37E-30	3.37E-27
2s 2p <sup>1</sup> P <sub>1</sub>	211271	84	0.	0.	0.	0.	0.	0.	2.04E-36	9.53E-33	9.50E-30	3.37E-27
	207974	24	0.	0.	0.	0.	0.	0.	2.20E-36	8.62E-33	7.90E-30	2.60E-27
	224495	72	0.	0.	0.	0.	0.	0.	0.	3.47E-35	5.44E-32	2.50E-29
	244960	120	0.	0.	0.	0.	0.	0.	0.	8.70E-36	2.50E-34	7.10E-31
	266160	204	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2s 2p <sup>3</sup> P <sub>2</sub>	252000	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	270000	60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	280000	100	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	300000	320	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	323100	100	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p <sup>1</sup> P <sub>1</sub>	354000	192	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	380100	36	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	390000	64	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	421200	72	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	454000	128	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p <sup>3</sup> P <sub>2</sub>	471120	100	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	510000	320	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	564000	100	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	544277	192	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	439000	192	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
MONITORED ENERGY LEVELS FROM MOORE (1949) AND ERIKSSON (1950)

TABLE 52 (CONT.-1). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF H<sup>+</sup>

LEVEL (CM-1)	TEMPERATURE (DEG K)											
	4000	5200	5400	6000	6400	6800	7200	7600	8000	8400	8800	9200
0	1.13E-01	1.13E-01	1.12E-01	1.12E-01	1.11E-01	1.11E-01	1.10E-01	1.10E-01	1.09E-01	1.08E-01	1.08E-01	1.07E-01
48	3.35E-01	3.34E-01	3.33E-01	3.32E-01	3.30E-01	3.29E-01	3.27E-01	3.26E-01	3.24E-01	3.22E-01	3.20E-01	3.19E-01
130	5.45E-01	5.45E-01	5.44E-01	5.43E-01	5.40E-01	5.37E-01	5.37E-01	5.36E-01	5.34E-01	5.30E-01	5.27E-01	5.24E-01
13316	5.75E-03	8.15E-03	1.10E-02	1.42E-02	1.70E-02	2.17E-02	2.50E-02	2.78E-02	3.05E-02	3.32E-02	3.58E-02	3.80E-02
32689	5.30E-06	1.33E-05	2.53E-05	4.61E-05	7.16E-05	1.10E-04	1.60E-04	2.25E-04	3.05E-04	4.01E-04	5.14E-04	6.49E-04
44785	4.61E-07	1.55E-06	3.50E-06	7.51E-06	1.51E-05	2.70E-05	4.79E-05	7.00E-05	1.21E-04	1.79E-04	2.54E-04	3.54E-04
92245	4.27E-12	1.30E-11	6.59E-11	4.15E-10	1.65E-09	5.55E-09	1.63E-08	4.25E-08	1.02E-07	2.23E-07	4.95E-07	1.07E-06
102216	6.18E-15	7.64E-16	6.58E-16	4.25E-12	2.75E-11	9.17E-11	3.25E-10	1.03E-09	2.89E-09	7.32E-09	1.79E-08	3.68E-08
155127	1.18E-21	7.75E-20	1.65E-19	2.35E-17	2.50E-16	1.89E-15	1.14E-14	5.78E-14	2.90E-13	9.30E-13	3.12E-12	9.30E-12
144180	6.63E-20	2.64E-18	4.50E-17	5.59E-16	4.65E-15	3.12E-14	1.69E-13	7.65E-13	2.90E-12	1.02E-11	3.11E-11	8.62E-11
166766	6.64E-23	3.09E-21	8.32E-20	1.44E-18	1.74E-17	1.57E-16	1.11E-15	6.39E-15	3.00E-14	1.20E-13	4.65E-13	1.51E-12
218000	4.27E-29	6.47E-27	4.79E-25	1.99E-23	5.21E-22	9.25E-21	1.19E-19	1.16E-18	9.20E-18	5.52E-17	3.21E-16	1.50E-15
224000	8.77E-31	1.71E-28	1.50E-26	7.92E-25	2.44E-23	5.01E-22	7.36E-21	8.14E-20	7.07E-19	5.00E-18	2.96E-17	1.50E-16
244000	6.67E-34	2.13E-33	3.92E-31	3.50E-29	1.87E-27	6.10E-26	1.39E-24	2.16E-23	2.61E-22	2.49E-21	1.97E-20	1.26E-19
149056	5.37E-20	1.64E-18	3.15E-17	4.02E-16	3.74E-15	2.67E-14	1.53E-13	7.31E-13	2.96E-12	1.04E-11	3.37E-11	9.64E-11
169022	4.05E-23	1.90E-20	5.59E-19	1.01E-17	1.24E-16	1.17E-15	8.50E-15	5.00E-14	2.44E-13	1.04E-12	3.04E-12	1.20E-11
187693	2.51E-24	1.09E-22	3.69E-21	1.91E-19	3.14E-18	3.74E-17	3.40E-16	2.43E-15	1.43E-14	7.09E-14	3.04E-13	1.13E-12
196975	1.12E-26	2.92E-24	1.42E-22	4.13E-21	7.87E-20	1.04E-18	1.07E-17	8.42E-17	5.40E-16	2.90E-15	1.34E-14	5.39E-14
203384	1.54E-28	1.94E-26	8.19E-24	2.65E-22	5.57E-20	8.16E-19	8.04E-18	7.40E-17	5.10E-16	2.90E-15	1.40E-14	5.92E-14
210284	2.87E-27	3.65E-25	2.32E-23	8.44E-22	1.97E-20	3.16E-19	3.72E-18	3.20E-17	2.44E-16	1.40E-15	7.54E-15	3.34E-14
211271	2.99E-27	3.80E-25	2.32E-23	9.35E-22	2.21E-20	3.59E-19	4.20E-18	3.92E-17	2.80E-16	1.75E-15	9.01E-15	4.02E-14
207974	2.39E-27	2.77E-25	1.60E-23	5.89E-22	1.32E-20	2.04E-19	2.34E-18	2.09E-17	1.49E-16	8.79E-16	4.41E-15	1.92E-14
224455	2.71E-29	4.59E-27	4.34E-25	2.10E-23	6.23E-22	1.84E-20	1.74E-19	1.90E-18	1.61E-17	1.11E-16	6.49E-16	3.21E-15
244500	2.02E-31	5.64E-29	7.05E-27	4.62E-25	1.80E-23	4.53E-22	7.90E-21	1.04E-19	1.04E-18	8.43E-17	5.63E-16	3.10E-15
264100	9.97E-34	4.50E-31	8.77E-29	6.33E-27	4.47E-25	1.54E-23	3.41E-22	5.37E-21	6.07E-20	6.07E-19	5.27E-18	3.47E-17
292000	3.55E-33	1.10E-30	1.71E-28	1.20E-26	5.54E-25	1.94E-23	2.97E-22	4.10E-21	4.52E-20	3.00E-19	2.79E-18	1.64E-17
270000	6.84E-35	2.43E-32	5.03E-30	3.11E-28	2.91E-26	1.83E-24	2.44E-23	4.16E-22	5.33E-21	5.35E-20	4.39E-19	2.94E-18
280000	3.64E-37	2.79E-34	8.23E-32	1.14E-30	6.47E-28	3.04E-26	1.12E-24	2.39E-23	3.49E-22	4.00E-21	3.03E-20	2.04E-19
309000	0.	2.14E-36	9.73E-34	1.95E-31	2.02E-29	1.21E-27	4.50E-26	1.10E-24	2.21E-23	3.12E-22	3.44E-21	3.11E-20
323100	0.	0.	1.00E-35	2.71E-33	3.42E-31	2.44E-29	1.00E-27	3.22E-26	6.83E-25	1.00E-23	1.33E-22	1.31E-21
354800	0.	0.	0.	2.41E-36	4.89E-34	5.31E-32	3.42E-30	1.42E-28	4.04E-27	8.42E-26	1.33E-24	1.64E-23
368100	0.	3.84E-37	1.69E-34	3.30E-32	3.35E-30	1.97E-28	7.26E-27	1.84E-25	3.30E-24	4.70E-23	5.14E-22	4.57E-21
339600	0.	0.	8.74E-38	2.93E-35	4.75E-33	4.23E-31	2.20E-29	8.09E-28	2.01E-26	3.64E-25	5.13E-24	5.71E-23
3.000	0.	0.	0.	9.95E-38	2.32E-35	2.04E-33	2.04E-31	9.32E-30	2.91E-28	6.53E-27	1.10E-25	1.64E-24
394000	0.	0.	0.	0.	0.	5.79E-36	6.89E-34	3.00E-32	1.64E-30	4.03E-29	1.00E-27	1.74E-26
390000	0.	0.	0.	0.	1.59E-36	2.40E-34	1.13E-32	1.13E-30	4.09E-29	1.07E-27	2.62E-26	2.99E-25
412000	0.	0.	0.	0.	0.	4.90E-37	6.19E-35	4.40E-33	7.80E-31	1.92E-29	1.92E-28	3.54E-27
466000	0.	0.	0.	0.	0.	1.84E-37	4.44E-35	3.17E-33	1.40E-31	5.22E-30	1.24E-28	2.26E-27
439000	0.	0.	0.	0.	0.	0.	1.60E-37	1.60E-35	1.07E-33	4.59E-32	1.33E-30	3.14E-29

TABLE 52 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS BY  $n$ 

LEVEL ( $n$ )	TEMPERATURE (°K)									
	9400	10000	11000	12000	13000	14000	15000	16000	17000	18000
0	1.04E-01	1.04E-01	1.04E-01	1.03E-01	1.01E-01	9.97E-02	9.83E-02	9.69E-02	9.55E-02	9.41E-02
40	3.17E-01	3.17E-01	3.17E-01	3.03E-01	2.92E-01	2.80E-01	2.67E-01	2.54E-01	2.42E-01	2.30E-01
130	5.22E-01	5.19E-01	5.12E-01	4.95E-01	4.79E-01	4.62E-01	4.45E-01	4.28E-01	4.12E-01	3.96E-01
13316	9.04E-02	9.04E-02	9.04E-02	8.14E-02	7.31E-02	6.54E-02	5.82E-02	5.15E-02	4.53E-02	3.96E-02
32409	7.93E-04	7.93E-04	7.93E-04	7.11E-04	6.36E-04	5.66E-04	5.00E-04	4.38E-04	3.80E-04	3.26E-04
44705	4.79E-04	4.79E-04	4.79E-04	4.02E-04	3.31E-04	2.65E-04	2.04E-04	1.48E-04	9.75E-05	5.10E-05
92245	1.38E-06	1.38E-06	1.38E-06	1.04E-06	7.93E-07	5.94E-07	4.12E-07	2.71E-07	1.61E-07	8.60E-08
193116	7.35E-08	7.35E-08	7.35E-08	5.43E-08	4.02E-08	2.92E-08	2.04E-08	1.38E-08	8.95E-09	5.40E-09
193127	2.58E-11	2.58E-11	2.58E-11	1.82E-11	1.30E-11	9.34E-12	6.64E-12	4.54E-12	3.04E-12	2.04E-12
144106	2.19E-10	2.19E-10	2.19E-10	1.54E-10	1.04E-10	7.14E-11	4.94E-11	3.34E-11	2.24E-11	1.44E-11
144704	4.46E-12	4.46E-12	4.46E-12	3.04E-12	2.04E-12	1.34E-12	8.94E-13	5.94E-13	3.94E-13	2.54E-13
210000	2.27E-14	2.27E-14	2.27E-14	1.44E-14	9.44E-15	6.14E-15	4.04E-15	2.64E-15	1.74E-15	1.14E-15
220000	6.12E-16	6.12E-16	6.12E-16	3.94E-16	2.54E-16	1.64E-16	1.04E-16	6.94E-17	4.54E-17	2.94E-17
264000	6.97E-19	6.97E-19	6.97E-19	4.44E-19	2.84E-19	1.84E-19	1.24E-19	8.14E-20	5.34E-20	3.54E-20
149056	2.54E-10	2.54E-10	2.54E-10	1.64E-10	1.04E-10	6.94E-11	4.54E-11	3.04E-11	2.04E-11	1.34E-11
169022	3.02E-11	3.02E-11	3.02E-11	1.94E-11	1.24E-11	8.14E-12	5.34E-12	3.54E-12	2.34E-12	1.54E-12
187693	3.08E-12	3.08E-12	3.08E-12	1.94E-12	1.24E-12	8.14E-13	5.34E-13	3.54E-13	2.34E-13	1.54E-13
194955	1.93E-13	1.93E-13	1.93E-13	1.24E-13	8.14E-14	5.34E-14	3.54E-14	2.34E-14	1.54E-14	1.04E-14
203304	2.21E-13	2.21E-13	2.21E-13	1.44E-13	9.44E-14	6.14E-14	4.04E-14	2.64E-14	1.74E-14	1.14E-14
210204	1.31E-13	1.31E-13	1.31E-13	8.14E-14	5.34E-14	3.54E-14	2.34E-14	1.54E-14	1.04E-14	6.94E-15
211271	1.59E-13	1.59E-13	1.59E-13	1.04E-13	6.94E-14	4.54E-14	3.04E-14	2.04E-14	1.34E-14	8.94E-15
224454	1.39E-14	1.39E-14	1.39E-14	8.14E-15	5.34E-15	3.54E-15	2.34E-15	1.54E-15	1.04E-15	6.94E-16
244500	1.54E-15	1.54E-15	1.54E-15	9.44E-16	6.14E-16	4.04E-16	2.64E-16	1.74E-16	1.14E-16	7.44E-17
260100	1.95E-16	1.95E-16	1.95E-16	1.24E-16	8.14E-17	5.34E-17	3.54E-17	2.34E-17	1.54E-17	1.04E-17
252000	8.42E-17	8.42E-17	8.42E-17	5.34E-17	3.54E-17	2.34E-17	1.54E-17	1.04E-17	6.94E-18	4.54E-18
270000	1.70E-17	1.70E-17	1.70E-17	1.04E-17	6.94E-18	4.54E-18	3.04E-18	2.04E-18	1.34E-18	8.94E-19
280000	1.91E-18	1.91E-18	1.91E-18	1.24E-18	8.14E-19	5.34E-19	3.54E-19	2.34E-19	1.54E-19	1.04E-19
300000	2.38E-19	2.38E-19	2.38E-19	1.44E-19	9.44E-20	6.14E-20	4.04E-20	2.64E-20	1.74E-20	1.14E-20
323100	1.07E-20	1.07E-20	1.07E-20	6.94E-21	4.54E-21	3.04E-21	2.04E-21	1.34E-21	8.94E-22	5.94E-22
354000	1.45E-22	1.45E-22	1.45E-22	9.44E-23	6.14E-23	4.04E-23	2.64E-23	1.74E-23	1.14E-23	7.44E-24
380100	3.38E-22	3.38E-22	3.38E-22	2.14E-22	1.44E-22	9.44E-23	6.14E-23	4.04E-23	2.64E-23	1.74E-23
330000	5.04E-23	5.04E-23	5.04E-23	3.24E-23	2.14E-23	1.44E-23	9.44E-24	6.14E-24	4.04E-24	2.64E-24
340000	1.84E-23	1.84E-23	1.84E-23	1.14E-23	7.44E-24	4.94E-24	3.24E-24	2.14E-24	1.44E-24	9.44E-25
340000	2.26E-23	2.26E-23	2.26E-23	1.44E-23	9.44E-24	6.14E-24	4.04E-24	2.64E-24	1.74E-24	1.14E-24
390000	3.53E-24	3.53E-24	3.53E-24	2.24E-24	1.44E-24	9.44E-25	6.14E-25	4.04E-25	2.64E-25	1.74E-25
412000	5.19E-25	5.19E-25	5.19E-25	3.24E-25	2.14E-25	1.44E-25	9.44E-26	6.14E-26	4.04E-26	2.64E-26
400000	3.19E-26	3.19E-26	3.19E-26	1.94E-26	1.24E-26	8.14E-27	5.34E-27	3.54E-27	2.34E-27	1.54E-27
430000	5.45E-28	5.45E-28	5.45E-28	3.34E-28	2.24E-28	1.44E-28	9.44E-29	6.14E-29	4.04E-29	2.64E-29

TABLE 52 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF H<sub>2</sub>

LEVEL	TEMPERATURE (DEG K)									
	10000	20000	28000	32000	36000	40000	44000	48000	0	0
0	8.72E-02	8.29E-02	7.87E-02	7.45E-02	7.03E-02	6.61E-02	6.19E-02	5.77E-02	0.	0.
48	2.61E-01	2.48E-01	2.36E-01	2.23E-01	2.10E-01	1.97E-01	1.84E-01	1.71E-01	0.	0.
130	4.32E-01	4.12E-01	3.91E-01	3.70E-01	3.49E-01	3.28E-01	3.07E-01	2.86E-01	0.	0.
15316	1.74E-01	1.69E-01	1.64E-01	1.59E-01	1.54E-01	1.49E-01	1.44E-01	1.39E-01	0.	0.
32489	1.23E-02	1.55E-02	1.81E-02	2.02E-02	2.22E-02	2.42E-02	2.62E-02	2.82E-02	0.	0.
46705	2.44E-02	3.74E-02	4.80E-02	5.74E-02	6.58E-02	7.32E-02	8.06E-02	8.80E-02	0.	0.
92245	1.61E-01	1.48E-01	1.35E-01	1.22E-01	1.09E-01	9.6E-02	8.3E-02	7.0E-02	0.	0.
108218	1.12E-03	2.78E-03	5.22E-03	8.52E-03	1.24E-02	1.62E-02	2.00E-02	2.38E-02	0.	0.
135127	2.39E-03	8.59E-03	2.21E-02	4.53E-02	7.83E-02	1.11E-01	1.44E-01	1.77E-01	0.	0.
144188	7.68E-05	2.51E-04	6.02E-04	1.17E-03	1.95E-03	2.93E-03	4.01E-03	5.09E-03	0.	0.
166766	1.19E-05	4.72E-05	1.31E-04	2.85E-04	5.22E-04	8.40E-04	1.22E-03	1.60E-03	0.	0.
210000	1.64E-06	1.02E-05	3.97E-05	1.10E-04	2.48E-04	4.72E-04	7.90E-04	1.11E-03	0.	0.
229000	4.74E-07	3.21E-06	1.71E-05	3.95E-05	9.27E-05	1.83E-04	3.16E-04	4.90E-04	0.	0.
264000	1.17E-06	1.04E-07	5.91E-07	1.95E-06	5.26E-06	1.14E-05	2.21E-05	3.64E-05	0.	0.
169056	1.38E-04	4.49E-04	1.14E-03	2.31E-03	3.95E-03	5.99E-03	8.32E-03	1.11E-02	0.	0.
169022	1.25E-04	5.04E-04	1.42E-03	3.12E-03	5.77E-03	9.34E-03	1.37E-02	1.85E-02	0.	0.
187933	4.79E-05	3.22E-04	1.02E-03	2.47E-03	4.91E-03	8.47E-03	1.31E-02	1.85E-02	0.	0.
196955	7.74E-06	4.00E-05	1.39E-04	3.41E-04	7.04E-04	1.25E-03	1.98E-03	2.81E-03	0.	0.
203384	1.59E-05	8.03E-05	3.02E-04	7.91E-04	1.60E-03	3.04E-03	4.99E-03	7.44E-03	0.	0.
210284	1.75E-05	1.01E-04	3.70E-04	1.00E-03	2.18E-03	4.05E-03	6.53E-03	9.44E-03	0.	0.
211271	2.31E-05	1.34E-04	4.92E-04	1.35E-03	2.95E-03	5.49E-03	9.02E-03	1.34E-02	0.	0.
207974	8.05E-06	4.54E-05	1.64E-04	4.59E-04	9.40E-04	1.75E-03	2.84E-03	4.26E-03	0.	0.
226425	7.90E-06	5.27E-05	2.15E-04	6.29E-04	1.46E-03	2.84E-03	4.90E-03	7.44E-03	0.	0.
244500	4.51E-06	3.48E-05	1.90E-04	5.10E-04	1.27E-03	2.44E-03	4.70E-03	7.04E-03	0.	0.
264100	3.95E-06	3.07E-05	1.92E-04	6.80E-04	1.87E-03	4.10E-03	7.97E-03	1.27E-02	0.	0.
253000	4.79E-07	3.94E-06	1.89E-05	4.30E-05	1.42E-04	3.42E-04	6.34E-04	1.11E-03	0.	0.
270000	4.09E-07	4.09E-06	2.52E-05	9.20E-05	2.55E-04	5.74E-04	1.11E-03	1.85E-03	0.	0.
280000	2.77E-07	3.10E-06	1.87E-05	7.97E-05	2.22E-04	5.31E-04	1.09E-03	1.79E-03	0.	0.
300000	2.40E-07	3.44E-06	2.25E-05	1.00E-04	3.44E-04	6.34E-04	1.19E-03	1.79E-03	0.	0.
323100	3.64E-08	5.31E-07	4.17E-06	1.90E-05	6.78E-05	1.82E-04	4.60E-04	8.04E-04	0.	0.
354000	9.69E-09	1.92E-07	1.70E-06	9.93E-06	3.06E-05	1.13E-04	2.79E-04	5.41E-04	0.	0.
368100	2.99E-09	3.97E-07	2.75E-06	1.20E-05	3.88E-05	9.91E-05	2.12E-04	3.64E-04	0.	0.
379000	7.94E-09	1.39E-07	1.17E-06	6.03E-06	2.21E-05	6.25E-05	1.44E-04	2.54E-04	0.	0.
394000	2.69E-09	4.49E-08	4.42E-07	2.50E-06	1.04E-05	3.19E-05	7.94E-05	1.34E-04	0.	0.
394000	5.44E-10	1.54E-08	1.04E-07	1.20E-06	5.04E-06	1.99E-05	5.41E-05	1.34E-04	0.	0.
394000	2.69E-09	4.49E-08	5.30E-07	3.40E-06	1.44E-05	4.72E-05	1.23E-04	2.12E-04	0.	0.
412000	5.23E-10	1.70E-08	2.27E-07	1.40E-06	6.21E-06	2.95E-05	8.37E-05	1.54E-04	0.	0.
440000	2.25E-10	7.03E-09	9.17E-08	6.64E-07	3.20E-06	1.13E-05	3.19E-05	7.44E-05	0.	0.
459000	6.22E-11	2.34E-09	4.05E-08	3.43E-07	1.87E-06	7.32E-06	2.24E-05	4.60E-05	0.	0.

TABLE 53. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O<sup>+</sup>

STATE	LEVEL (CM <sup>-1</sup> )	STAT. WT.	TEMPERATURE (DEG K)									
			1200	1500	2000	2400	2750	3200	3600	4000	4400	4600
2p <sup>2</sup> 3p <sup>2</sup>	0	4	1.00E 20	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
2p <sup>2</sup> 3p <sup>2</sup>	26019	10	2.71E-14	0.40E-11	1.04E-06	2.04E-07	1.49E-05	5.35E-05	1.42E-05	1.42E-05	1.42E-05	1.42E-05
2p <sup>2</sup> 3p <sup>2</sup>	40447	6	1.27E-21	2.30E-16	3.41E-13	4.37E-11	1.40E-09	1.60E-08	1.42E-07	1.42E-07	1.42E-07	1.42E-07
2p <sup>2</sup> 3p <sup>2</sup>	119933	12	0.	0.	1.02E-37	1.70E-31	5.10E-27	1.14E-23	4.57E-20	2.32E-19	7.78E-17	7.78E-17
2p <sup>2</sup> 3p <sup>2</sup>	169991	10	0.	0.	0.	0.	2.20E-37	9.60E-33	3.80E-28	2.70E-26	6.60E-24	6.60E-24
2p <sup>2</sup> 3p <sup>2</sup>	199710	2	0.	0.	0.	0.	0.	3.04E-39	5.20E-35	1.30E-31	2.04E-29	2.04E-29
2p <sup>2</sup> 3p <sup>2</sup>	212450	6	0.	0.	0.	0.	0.	0.	1.55E-37	4.00E-34	9.40E-31	9.40E-31
2p <sup>2</sup> 3p <sup>2</sup>	317400	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p <sup>2</sup> 3p <sup>2</sup>	186404	18	0.	0.	0.	0.	0.	1.44E-36	1.44E-32	3.10E-29	1.42E-26	1.42E-26
2p <sup>2</sup> 3p <sup>2</sup>	209200	54	0.	0.	0.	0.	0.	0.	6.57E-32	1.81E-32	2.63E-29	2.63E-29
2p <sup>2</sup> 3p <sup>2</sup>	232343	90	0.	0.	0.	0.	0.	0.	0.	1.55E-35	2.11E-32	2.11E-32
2p <sup>2</sup> 3p <sup>2</sup>	239246	18	0.	0.	0.	0.	0.	0.	0.	1.04E-37	4.40E-34	4.40E-34
2p <sup>2</sup> 3p <sup>2</sup>	246000	54	0.	0.	0.	0.	0.	0.	0.	0.	1.37E-35	1.37E-35
2p <sup>2</sup> 3p <sup>2</sup>	255006	90	0.	0.	0.	0.	0.	0.	0.	0.	1.52E-35	1.52E-35
2p <sup>2</sup> 3p <sup>2</sup>	259532	126	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(D) 3p	206972	10	0.	0.	0.	0.	0.	0.	2.97E-36	1.74E-32	1.31E-29	1.31E-29
(D) 3p	229090	30	0.	0.	0.	0.	0.	0.	0.	9.19E-34	1.63E-32	1.63E-32
(D) 3p	232571	50	0.	0.	0.	0.	0.	0.	0.	0.	1.49E-35	1.49E-35
(D) 3p	272730	140	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(S) 3p	226951	2	0.	0.	0.	0.	0.	0.	0.	1.64E-36	3.74E-33	3.74E-33
3p	250251	6	0.	0.	0.	0.	0.	0.	0.	0.	4.33E-36	4.33E-36
3p	279551	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3p	296000	32	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p <sup>2</sup> 3p <sup>2</sup>	281000	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p <sup>2</sup> 3p <sup>2</sup>	313000	160	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(D) 3p	340000	270	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(D) 3p	371000	400	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(D) 3p	442449	400	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(D) 3p	474847	400	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(D) 3p	437000	54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(D) 3p	541797	500	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(D) 3p	642059	750	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
MONITORING ENERGY LEVELS FROM MOORE (1949) AND ERIKSSON (1961)

TABLE 53 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O<sup>+</sup>

LEVEL (CR-1)	TEMPERATURE (DEG K)									
	4000	5200	5400	6000	6400	6800	7000	8000	8400	9200
0	9.99E-01	9.90E-01	9.87E-01	9.84E-01	9.84E-01	9.91E-01	9.80E-01	9.79E-01	9.74E-01	9.61E-01
24019	0.04E-04	1.49E-03	2.54E-03	4.01E-03	5.90E-03	1.16E-03	1.16E-03	1.97E-02	3.62E-02	3.62E-02
40047	0.09E-06	2.09E-05	4.57E-05	9.12E-05	2.04E-04	4.56E-04	6.95E-04	1.01E-03	1.43E-03	2.57E-03
119333	7.31E-16	1.14E-14	1.24E-13	9.64E-13	5.82E-12	2.34E-11	1.14E-10	1.24E-09	3.50E-09	2.50E-08
169991	6.15E-22	2.82E-20	7.50E-19	1.24E-17	1.54E-16	1.30E-15	9.70E-15	2.65E-13	1.00E-12	1.20E-11
195710	1.64E-26	1.52E-24	7.25E-23	2.07E-21	3.00E-20	5.14E-19	3.99E-17	2.53E-16	1.35E-15	2.45E-14
212690	3.11E-28	4.19E-26	2.00E-24	1.07E-22	2.90E-21	5.20E-19	4.95E-18	2.22E-16	1.15E-15	5.20E-15
317400	0.	1.00E-36	5.74E-34	1.32E-33	1.53E-31	1.01E-29	4.22E-28	2.30E-25	3.50E-24	3.99E-22
184404	2.30E-24	1.70E-22	6.77E-21	1.49E-19	2.70E-18	3.10E-17	2.04E-16	1.17E-14	5.74E-14	9.14E-13
209200	7.04E-27	9.70E-25	6.10E-23	2.19E-21	5.93E-20	7.90E-19	9.37E-17	6.03E-16	3.60E-15	1.02E-14
232343	1.19E-29	2.54E-27	2.52E-25	1.33E-23	4.40E-22	9.50E-21	1.44E-19	1.51E-17	1.10E-16	6.60E-16
239346	3.12E-31	7.79E-29	6.01E-27	5.31E-25	1.91E-23	4.52E-22	7.51E-21	9.20E-20	6.07E-18	2.40E-16
244006	9.04E-32	2.92E-29	3.04E-27	2.63E-25	1.04E-23	2.77E-22	5.02E-21	6.91E-19	5.09E-18	3.07E-17
259006	1.43E-32	5.11E-30	7.09E-28	6.21E-26	2.03E-24	6.23E-23	1.64E-21	2.39E-20	2.34E-18	1.70E-17
259132	1.52E-32	5.54E-30	8.71E-28	6.97E-26	3.22E-24	9.40E-23	1.91E-21	3.16E-19	2.01E-18	1.25E-16
266972	2.09E-27	3.34E-25	2.01E-23	6.94E-22	1.54E-20	2.37E-19	2.69E-18	2.37E-17	9.70E-16	2.11E-14
229990	0.05E-30	1.77E-27	1.67E-25	0.93E-24	2.67E-22	5.57E-21	9.20E-20	0.11E-18	5.70E-17	1.75E-15
252571	1.05E-32	5.57E-30	8.19E-28	6.19E-26	2.72E-24	7.44E-23	1.49E-21	2.29E-19	1.90E-18	1.01E-17
272930	1.00E-34	6.30E-32	1.40E-29	1.50E-27	6.94E-26	3.30E-24	1.35E-23	1.00E-20	1.04E-19	1.01E-17
224051	1.47E-30	2.75E-28	2.43E-26	1.10E-24	3.53E-23	7.07E-22	1.01E-20	9.34E-19	6.49E-18	3.77E-17
262231	3.07E-33	1.27E-30	1.70E-28	1.30E-26	5.50E-25	1.50E-23	2.04E-22	4.17E-20	3.54E-19	1.45E-17
279921	2.90E-36	1.73E-33	4.03E-31	4.35E-29	2.04E-27	1.09E-25	2.70E-24	6.04E-22	7.23E-21	6.10E-20
290000	0.	2.16E-35	7.44E-33	1.19E-30	1.00E-28	5.01E-27	1.42E-25	5.99E-23	7.44E-22	6.07E-20
313000	0.	3.09E-33	9.92E-31	1.22E-28	8.21E-27	3.37E-25	9.12E-24	2.40E-23	2.74E-20	1.70E-18
	0.	9.77E-37	4.74E-34	1.01E-31	1.10E-29	6.04E-28	2.71E-26	1.40E-25	2.63E-22	2.31E-21
340000	0.	0.	7.77E-37	2.62E-34	4.20E-32	3.02E-30	2.07E-28	1.04E-25	3.33E-24	3.24E-22
373000	0.	0.	0.	0.	4.54E-35	6.31E-33	5.04E-31	0.43E-28	2.90E-26	3.39E-24
383000	0.	0.	0.	0.	4.51E-36	7.15E-34	6.41E-32	1.34E-28	3.54E-26	1.00E-24
437000	0.	0.	0.	0.	0.	0.	1.61E-36	1.50E-34	4.16E-31	2.74E-28
534000	0.	0.	0.	0.	0.	0.	0.	0.	0.	9.70E-35



TABLE 53 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O-

LEVEL (cm <sup>-1</sup> )	TEMPERATURE (DEG K)									
	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000
0	9.54E-01	9.44E-01	9.24E-01	8.99E-01	8.73E-01	8.44E-01	8.12E-01	7.81E-01	7.50E-01	7.19E-01
26017	4.28E-02	4.96E-02	6.92E-02	9.02E-02	1.12E-01	1.34E-01	1.56E-01	1.77E-01	2.00E-01	2.21E-01
46049	3.32E-03	4.20E-03	6.97E-03	1.02E-02	1.49E-02	2.13E-02	2.93E-02	3.90E-02	5.05E-02	6.38E-02
119033	4.57E-06	9.10E-06	4.24E-07	1.53E-06	4.50E-06	1.13E-05	2.40E-05	4.92E-05	8.66E-05	1.52E-04
169991	3.74E-11	1.00E-10	8.60E-10	5.11E-09	2.70E-09	8.25E-09	2.49E-07	6.51E-06	1.51E-05	3.20E-05
192710	8.71E-14	2.79E-13	3.93E-12	2.90E-11	1.71E-10	7.70E-10	2.80E-09	9.00E-09	2.42E-08	5.94E-08
212450	2.04E-14	7.32E-14	1.15E-12	1.16E-11	7.87E-11	4.09E-10	1.70E-09	5.00E-09	1.45E-08	3.85E-07
317600	3.13E-21	2.02E-20	1.29E-18	6.00E-17	7.25E-16	8.65E-15	7.36E-14	4.73E-13	2.17E-12	1.06E-11
186604	3.07E-12	9.51E-12	1.04E-10	7.77E-10	4.22E-09	1.79E-08	6.21E-08	1.84E-07	4.70E-07	1.11E-06
209200	3.11E-13	1.00E-12	1.63E-11	1.55E-10	1.04E-09	5.25E-09	2.13E-08	7.22E-08	2.11E-07	5.92E-07
235653	1.56E-14	6.23E-14	1.20E-12	1.57E-11	1.30E-10	7.93E-10	3.70E-09	1.47E-08	4.07E-08	1.43E-07
239348	1.13E-15	4.71E-15	1.05E-13	1.39E-12	1.23E-11	7.90E-11	3.94E-10	1.60E-09	5.49E-09	1.63E-08
244840	1.10E-15	4.80E-15	1.10E-13	1.70E-12	1.61E-11	1.10E-10	5.79E-10	2.44E-09	8.72E-09	2.69E-08
258004	5.01E-16	2.40E-15	6.79E-14	1.07E-12	1.09E-11	7.00E-11	4.39E-10	1.94E-09	7.29E-09	2.34E-08
259432	6.09E-16	3.03E-15	8.43E-14	1.33E-12	1.37E-11	1.01E-10	5.62E-10	2.32E-09	9.44E-09	3.04E-08
260972	8.05E-14	2.76E-13	4.04E-12	3.75E-11	2.44E-10	1.22E-09	4.09E-09	1.43E-08	4.72E-08	1.21E-07
269906	7.77E-15	3.04E-14	6.04E-13	7.21E-12	3.48E-11	1.45E-10	1.43E-09	4.20E-09	1.47E-08	3.41E-07
282371	4.32E-14	1.94E-13	5.19E-12	7.93E-12	7.90E-11	5.44E-11	3.00E-10	1.35E-09	4.00E-09	1.11E-07
272330	6.36E-17	3.34E-16	1.14E-14	2.21E-13	2.64E-12	2.23E-11	1.40E-10	6.94E-10	3.02E-09	1.02E-08
226051	6.10E-16	3.10E-15	6.00E-14	6.52E-13	5.45E-12	3.17E-11	1.45E-10	5.76E-10	1.76E-09	5.99E-09
290251	7.36E-17	3.27E-16	8.44E-15	1.26E-13	1.23E-12	8.59E-12	4.62E-11	2.00E-10	7.27E-10	2.20E-09
279951	2.61E-18	1.35E-17	4.00E-16	9.61E-15	1.16E-14	1.02E-12	6.54E-12	3.31E-11	1.30E-10	4.07E-10
286000	4.13E-19	2.42E-18	1.13E-16	2.70E-15	4.14E-14	4.36E-13	3.04E-12	1.74E-11	8.07E-11	3.14E-10
281000	1.10E-17	5.00E-17	2.27E-15	4.72E-14	6.12E-13	5.97E-12	3.63E-11	1.89E-10	8.60E-10	3.92E-09
313000	1.62E-19	1.05E-18	6.13E-17	1.01E-15	3.15E-14	3.42E-13	2.99E-12	1.89E-11	9.57E-11	4.02E-10
340000	4.77E-21	3.63E-20	3.03E-18	1.20E-16	2.60E-15	3.01E-14	3.79E-13	2.01E-12	1.44E-11	7.04E-11
379000	6.93E-23	5.40E-22	7.10E-20	4.00E-18	1.23E-16	2.20E-15	2.04E-14	5.57E-13	7.79E-12	9.99E-12
383000	1.26E-23	1.24E-22	1.62E-20	1.15E-18	3.83E-17	7.66E-16	1.02E-14	9.04E-14	7.20E-13	4.21E-12
437000	4.72E-27	6.42E-26	1.91E-23	2.17E-21	1.19E-19	3.44E-18	7.03E-17	9.34E-16	4.10E-15	2.11E-14
594000	3.12E-33	7.61E-32	8.95E-29	2.83E-26	3.52E-24	2.32E-22	8.73E-21	2.67E-19	3.30E-18	2.69E-16

TABLE 53 (CONT.) 1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O<sup>+</sup>

LEVEL	(CM <sup>-1</sup> )	TEMPERATURE (DEG K)									
		24000	26000	32000	34000	40000	44000	48000	0	0	0
6		6.11E-01	5.48E-01	4.97E-01	4.55E-01	4.19E-01	3.84E-01	3.55E-01	0.	0.	0.
24817		3.04E-01	3.45E-01	3.72E-01	3.96E-01	4.02E-01	4.02E-01	3.97E-01	0.	0.	0.
40447		6.0E-02	1.03E-01	1.21E-01	1.34E-01	1.47E-01	1.54E-01	1.56E-01	0.	0.	0.
119933		1.38E-03	3.44E-03	6.79E-03	1.13E-02	1.68E-02	2.29E-02	2.92E-02	0.	0.	0.
169991		7.29E-05	2.71E-04	7.13E-03	1.50E-03	2.07E-03	4.24E-03	6.13E-03	0.	0.	0.
199710		2.45E-04	1.17E-03	3.75E-05	9.13E-05	1.64E-04	3.21E-04	5.03E-04	0.	0.	0.
212650		2.67E-04	1.40E-03	3.25E-05	1.59E-04	3.80E-04	5.53E-04	7.80E-04	0.	0.	0.
317400		5.00E-05	6.78E-08	4.73E-07	2.11E-06	6.92E-06	1.80E-05	3.93E-05	0.	0.	0.
186404		3.81E-05	1.67E-04	5.08E-04	1.10E-03	2.29E-03	3.89E-03	5.95E-03	0.	0.	0.
209208		2.92E-05	1.59E-04	5.52E-04	1.44E-03	3.05E-03	5.57E-03	9.04E-03	0.	0.	0.
232543		1.21E-05	7.94E-05	3.22E-04	9.41E-04	2.20E-03	4.33E-03	7.50E-03	0.	0.	0.
239348		1.61E-04	1.12E-05	4.74E-05	1.44E-04	3.44E-04	6.92E-04	1.22E-03	0.	0.	0.
244540		3.09E-04	2.20E-05	1.01E-04	3.19E-04	7.83E-04	1.63E-03	2.93E-03	0.	0.	0.
285806		3.14E-04	2.51E-05	1.17E-04	3.84E-04	9.79E-04	2.04E-03	3.63E-03	0.	0.	0.
253952		4.10E-04	3.35E-05	1.57E-04	4.10E-04	1.33E-03	2.82E-03	5.21E-03	0.	0.	0.
206972		6.24E-04	3.29E-05	1.13E-04	2.91E-04	6.12E-04	1.11E-03	1.79E-03	0.	0.	0.
239898		4.74E-04	3.04E-05	1.21E-04	3.49E-04	8.05E-04	1.57E-03	2.71E-03	0.	0.	0.
252571		2.03E-04	1.58E-05	7.27E-05	2.35E-04	5.94E-04	1.25E-03	2.29E-03	0.	0.	0.
272930		1.92E-04	1.78E-05	9.31E-05	3.33E-04	9.14E-04	2.04E-03	3.90E-03	0.	0.	0.
224851		3.79E-07	2.37E-06	9.24E-06	2.63E-05	5.99E-05	1.34E-04	1.90E-04	0.	0.	0.
250251		2.89E-07	2.14E-06	9.10E-06	3.10E-05	7.75E-05	1.62E-04	2.94E-04	0.	0.	0.
275951		9.99E-08	9.51E-07	5.68E-06	1.89E-05	5.12E-05	1.14E-04	2.27E-04	0.	0.	0.
284080		9.41E-08	1.69E-06	4.40E-06	2.66E-05	7.07E-05	1.93E-04	3.90E-04	0.	0.	0.
281000		6.84E-07	4.60E-06	3.44E-05	1.34E-04	3.84E-04	8.84E-04	1.74E-03	0.	0.	0.
313000		1.73E-07	2.27E-06	1.54E-05	6.72E-05	2.16E-04	5.54E-04	1.25E-03	0.	0.	0.
340000		5.80E-08	9.54E-07	7.70E-06	3.80E-05	1.30E-04	3.87E-04	8.90E-04	0.	0.	0.
373000		1.43E-08	3.12E-07	3.11E-06	1.83E-05	7.45E-05	2.34E-04	5.94E-04	0.	0.	0.
383000		7.34E-09	1.75E-07	1.84E-06	1.15E-05	4.00E-05	1.50E-04	4.13E-04	0.	0.	0.
437000		3.52E-10	1.33E-08	2.00E-07	1.63E-06	8.59E-06	3.30E-05	9.99E-05	0.	0.	0.
534000		1.43E-12	1.24E-10	3.40E-09	4.60E-08	3.58E-07	1.84E-06	7.44E-06	0.	0.	0.

TABLE 54. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ar\*

STATE	LEVEL (CM-1)	LEVEL (EV)	STAT. WT.	TEMPERATURE (DEG K)									
				1200	1600	2000	2400	2800	3200	3600	4000	4400	
3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup>	0	0.	4	9.18E-01	8.79E-01	8.49E-01	8.25E-01	8.07E-01	7.92E-01	7.80E-01	7.70E-01	7.62E-01	
	1432	0.1775	2	8.24E-02	1.21E-01	1.51E-01	1.75E-01	1.93E-01	2.08E-01	2.20E-01	2.30E-01	2.38E-01	
	108723	13.4796	2	0.	0.	4.54E-35	2.04E-29	2.20E-25	2.35E-22	2.52E-20	2.70E-18	2.88E-16	
	132476	16.4245	20	0.	0.	0.	1.33E-34	1.10E-29	5.36E-24	3.95E-23	2.70E-21	1.85E-19	
	146319	18.1408	70	0.	0.	0.	1.10E-37	3.14E-32	3.72E-28	5.47E-25	1.67E-22	2.22E-20	
(D)3d	136028	16.8649	18	0.	0.	0.	1.42E-35	1.60E-30	9.77E-27	8.60E-24	1.99E-21	1.65E-19	
	158023	19.5918	54	0.	0.	0.	0.	5.92E-35	3.93E-30	3.93E-27	2.14E-24	3.72E-22	
	186493	23.1466	90	0.	0.	0.	0.	0.	6.25E-34	6.01E-32	1.10E-28	5.24E-26	
	195547	24.2464	126	0.	0.	0.	0.	0.	1.42E-37	2.79E-33	6.83E-30	4.04E-27	
	164082	20.3431	50	0.	0.	0.	0.	2.43E-34	9.03E-32	3.23E-28	2.25E-25	4.75E-23	
(5)3d	168754	18.4427	10	0.	0.	0.	0.	1.20E-33	1.78E-29	2.95E-24	1.11E-23	1.43E-21	
	171831	21.3038	30	0.	0.	0.	0.	0.	1.64E-33	8.75E-30	8.30E-27	2.74E-24	
	198457	24.7537	50	0.	0.	0.	0.	0.	0.	2.14E-34	4.23E-31	4.21E-28	
	209029	25.9156	70	0.	0.	0.	0.	0.	0.	7.14E-34	2.99E-32	2.75E-29	
	179728	22.2829	10	0.	0.	0.	0.	0.	1.59E-35	1.24E-31	1.62E-28	5.70E-26	
3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup>	167309	20.7431	2	0.	0.	0.	0.	1.86E-38	8.44E-34	3.54E-30	2.81E-27	4.62E-25	
	192093	23.8161	6	0.	0.	0.	0.	0.	3.07E-38	5.33E-34	1.13E-30	5.99E-28	
	220000	27.2758	10	0.	0.	0.	0.	0.	0.	1.27E-38	8.20E-35	1.59E-31	
	228000	28.2677	14	0.	0.	0.	0.	0.	0.	0.	6.51E-36	1.11E-33	
	269000	33.5509	90	0.	0.	0.	0.	0.	0.	0.	0.	1.00E-37	
3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup> 3s 3p <sup>4</sup> 1P <sub>1</sub> <sup>o</sup>	249000	30.8713	18	0.	0.	0.	0.	0.	0.	0.	0.	1.49E-35	
	273000	33.8448	34	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	301000	37.3183	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	309000	38.3101	126	0.	0.	0.	0.	0.	0.	0.	0.	0.	

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTANDARD ENERGY LEVELS FROM MOORE (1949) AND MINNACHEN (1958,1960)

TABLE 54 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTROMIC POPULATIONS OF AR<sup>+</sup>

LEVEL (CM <sup>-1</sup> )	TEMPERATURE (DEG K)									
	4800	5200	5600	6000	6400	6800	7200	7600	8000	8400
0	7.54E-01	7.40E-01	7.43E-01	7.38E-01	7.34E-01	7.30E-01	7.27E-01	7.24E-01	7.21E-01	7.19E-01
1332	2.48E-01	2.52E-01	2.57E-01	2.61E-01	2.66E-01	2.70E-01	2.74E-01	2.78E-01	2.82E-01	2.86E-01
106723	2.43E-13	3.22E-14	2.74E-13	1.78E-12	8.70E-12	3.73E-11	1.33E-10	4.17E-10	1.14E-09	3.47E-09
132576	2.14E-17	4.51E-15	6.14E-15	9.90E-14	4.27E-13	2.42E-12	1.10E-11	4.64E-11	1.92E-10	1.40E-09
146319	1.18E-18	3.42E-17	6.13E-16	7.47E-15	6.65E-14	4.59E-13	2.95E-12	1.18E-11	4.70E-11	5.11E-10
134028	6.63E-18	1.52E-16	2.32E-15	2.28E-14	1.73E-13	1.04E-12	5.12E-12	2.13E-11	7.70E-11	2.44E-10
159023	2.73E-20	1.04E-18	2.34E-17	3.48E-16	3.69E-15	2.97E-14	1.90E-13	9.95E-13	4.42E-12	1.71E-11
186693	8.44E-24	6.20E-22	2.46E-20	5.99E-19	7.70E-18	1.15E-16	1.03E-15	7.28E-15	4.29E-14	2.09E-13
195567	8.26E-23	7.49E-21	3.53E-20	9.99E-20	1.86E-18	2.66E-17	2.44E-16	1.90E-15	1.21E-14	6.41E-14
164082	4.12E-21	1.79E-19	4.54E-18	7.53E-17	8.76E-16	7.63E-15	5.23E-14	2.92E-13	1.50E-12	5.99E-12
140754	9.15E-20	2.49E-18	4.48E-17	5.95E-16	5.50E-15	3.91E-14	2.24E-13	1.07E-12	4.34E-12	1.55E-11
171031	4.25E-22	1.24E-20	3.74E-19	7.05E-18	9.21E-17	8.89E-16	6.67E-15	4.05E-14	2.05E-13	8.90E-13
199637	9.63E-26	9.53E-24	4.99E-22	1.49E-20	2.94E-19	4.11E-18	4.28E-17	3.44E-16	2.29E-15	1.26E-14
209029	8.12E-27	9.90E-25	6.17E-23	2.20E-21	5.02E-20	7.02E-19	9.20E-18	8.24E-17	5.95E-16	3.55E-15
179728	7.54E-24	4.73E-22	1.64E-20	3.54E-19	5.20E-18	5.57E-17	4.59E-16	3.03E-15	1.65E-14	7.67E-14
167309	6.24E-23	2.94E-21	7.97E-20	1.39E-18	1.70E-17	1.54E-16	1.10E-15	4.35E-15	3.08E-14	1.29E-13
192095	1.11E-23	9.27E-24	4.10E-22	1.09E-20	1.94E-19	2.54E-18	2.33E-17	1.74E-16	1.07E-15	5.54E-15
220000	6.33E-29	6.63E-27	5.28E-25	2.28E-23	8.06E-22	1.11E-20	1.67E-19	1.44E-18	1.18E-17	7.75E-17
228000	5.51E-30	1.03E-27	9.43E-26	4.03E-24	1.61E-22	2.04E-21	4.15E-20	4.84E-19	3.42E-18	2.74E-17
269000	1.63E-34	7.99E-32	1.61E-29	1.61E-27	9.00E-26	3.14E-24	7.30E-23	1.22E-21	1.50E-20	1.59E-19
249000	1.31E-32	4.04E-30	5.50E-28	3.89E-26	1.61E-24	4.32E-23	8.94E-22	1.10E-20	1.15E-19	9.71E-19
273000	2.97E-35	1.50E-32	3.44E-30	3.69E-28	2.20E-26	8.08E-25	1.99E-23	3.50E-22	4.63E-21	4.78E-20
301000	0.	1.14E-35	4.33E-33	7.47E-31	6.74E-29	3.40E-27	1.23E-25	2.91E-24	5.01E-23	6.58E-22
309000	0.	1.74E-36	7.77E-34	1.54E-31	1.57E-29	9.28E-28	3.49E-26	8.97E-25	1.66E-23	2.54E-22
										2.59E-21
										2.32E-20

TABLE 54 (CONT. 1). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ar+

LEVEL	TEMPERATURE (DEG K)													
	9400	10000	11000	12000	13000	14000	15000	16000	17000	18000	19000	20000	21000	22000
0	7.11E-01	7.11E-01	7.07E-01	7.04E-01	7.01E-01	6.99E-01	6.96E-01	6.95E-01	6.93E-01	6.91E-01	6.90E-01	6.88E-01	6.87E-01	6.85E-01
1432	2.87E-01	2.89E-01	2.93E-01	2.94E-01	2.99E-01	3.01E-01	3.04E-01	3.05E-01	3.07E-01	3.08E-01	3.09E-01	3.10E-01	3.10E-01	3.10E-01
108723	2.99E-08	5.72E-08	2.36E-07	7.47E-07	2.00E-06	4.90E-06	1.03E-05	1.77E-05	3.49E-05	5.81E-05	9.14E-05	1.38E-04	1.94E-04	2.58E-04
132476	8.48E-09	1.87E-08	1.05E-07	4.45E-07	1.50E-06	4.27E-06	1.04E-05	2.33E-05	4.64E-05	8.71E-05	1.53E-04	2.58E-04	4.19E-04	6.48E-04
144319	3.73E-09	8.95E-09	6.04E-08	2.94E-07	1.14E-06	3.60E-06	9.79E-06	2.35E-05	5.08E-05	1.01E-04	1.86E-04	3.23E-04	5.19E-04	7.74E-04
134028	4.49E-09	1.01E-08	5.94E-08	2.61E-07	9.13E-07	2.67E-06	6.75E-06	1.42E-05	3.12E-05	5.90E-05	1.04E-04	1.74E-04	2.64E-04	3.94E-04
158023	4.98E-10	1.20E-09	1.01E-08	5.61E-08	2.40E-07	8.35E-07	2.64E-06	6.32E-06	1.45E-05	3.05E-05	5.92E-05	1.07E-04	1.67E-04	2.48E-04
184473	1.13E-11	3.45E-11	3.95E-10	3.01E-09	1.40E-08	7.31E-08	2.42E-07	8.00E-07	2.14E-06	5.14E-06	1.12E-05	2.58E-05	4.85E-05	8.48E-05
195567	4.19E-12	1.35E-11	1.73E-10	1.45E-09	6.70E-09	4.11E-08	1.50E-07	5.04E-07	1.41E-06	3.54E-06	8.04E-06	1.80E-05	3.48E-05	6.05E-05
164082	1.86E-10	4.94E-10	4.22E-09	2.51E-08	1.14E-07	4.15E-07	1.27E-06	3.39E-06	8.60E-06	1.74E-05	3.44E-05	6.32E-05	1.07E-04	1.67E-04
148754	3.70E-10	9.01E-10	4.27E-09	3.16E-08	1.24E-07	4.01E-07	1.11E-06	2.69E-06	5.90E-06	1.19E-05	2.21E-05	3.87E-05	6.17E-05	9.48E-05
171831	3.50E-11	9.77E-11	9.19E-10	5.94E-09	2.89E-08	1.12E-07	3.63E-07	1.01E-06	2.51E-06	5.42E-06	1.16E-05	2.21E-05	3.87E-05	6.17E-05
194457	9.00E-13	2.97E-12	4.02E-11	3.53E-10	2.22E-09	1.07E-08	4.19E-08	1.30E-07	3.97E-07	1.01E-06	2.74E-06	4.99E-06	8.48E-06	1.38E-05
209029	3.04E-13	1.00E-12	1.65E-11	1.61E-10	1.10E-09	5.72E-09	2.39E-08	8.34E-08	2.52E-07	6.71E-07	1.61E-06	3.55E-06	6.17E-06	1.07E-05
179728	3.57E-12	1.09E-11	1.09E-10	7.70E-10	4.03E-09	1.64E-08	5.67E-08	1.64E-07	4.29E-07	9.97E-07	2.12E-06	4.17E-06	7.14E-06	1.17E-05
167309	4.59E-12	1.25E-11	1.11E-10	6.83E-10	3.10E-09	1.19E-08	3.73E-08	1.02E-07	2.42E-07	5.30E-07	1.00E-06	2.04E-06	3.48E-06	5.48E-06
192095	3.35E-13	1.04E-12	1.50E-11	1.05E-10	6.14E-10	2.80E-09	1.04E-08	3.28E-08	9.04E-08	2.22E-07	4.90E-07	1.03E-06	1.83E-06	2.74E-06
220000	8.53E-15	3.10E-14	5.63E-13	6.16E-12	4.67E-11	2.65E-10	1.19E-09	4.44E-09	1.42E-08	3.94E-08	1.00E-07	2.30E-07	4.19E-07	6.48E-07
228000	3.60E-15	1.61E-14	2.77E-13	3.30E-12	2.70E-11	1.63E-10	7.15E-10	3.03E-09	1.01E-08	2.94E-08	7.67E-08	1.81E-07	3.48E-07	5.48E-07
269000	4.97E-17	2.40E-16	8.34E-15	1.54E-13	1.05E-12	1.55E-11	9.74E-11	4.08E-10	2.02E-09	7.14E-09	2.21E-08	6.10E-08	1.17E-07	1.74E-07
249500	1.99E-16	8.83E-16	2.28E-14	3.43E-13	3.39E-12	2.42E-11	1.33E-10	5.90E-10	2.20E-09	7.04E-09	2.01E-08	5.12E-08	1.17E-07	1.74E-07
272000	1.44E-17	8.30E-17	2.94E-15	5.78E-14	7.14E-13	3.99E-11	2.04E-10	8.44E-10	3.11E-09	9.79E-09	2.79E-08	6.11E-08	1.17E-07	1.74E-07
301000	4.10E-19	2.70E-18	1.27E-16	3.34E-15	5.37E-14	5.70E-12	4.53E-11	2.75E-10	1.39E-09	5.51E-09	1.94E-08	4.11E-08	8.48E-08	1.38E-07
304000	1.73E-19	1.10E-18	6.23E-17	1.80E-15	3.10E-14	3.56E-13	2.95E-12	1.87E-11	9.30E-11	4.06E-10	1.50E-09	4.81E-09	9.48E-09	1.38E-08

TABLE 54 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR+

LEVEL	TEMPERATURE (DEG K)									
	10000	20000	32000	40000	44000	48000	0	0	0	0
0	6.81E-01	4.47E-01	6.41E-01	5.92E-01	5.42E-01	4.74E-01	0.	0.	0.	0.
1332	3.12E-01	3.10E-01	3.01E-01	2.83E-01	2.57E-01	2.27E-01	0.	0.	0.	0.
109723	5.03E-04	1.23E-03	2.41E-03	3.80E-03	5.43E-03	6.80E-03	0.	0.	0.	0.
132474	1.21E-03	3.69E-03	8.30E-03	1.50E-02	2.31E-02	3.13E-02	0.	0.	0.	0.
144319	1.89E-03	6.34E-03	1.54E-02	3.03E-02	4.91E-02	6.96E-02	0.	0.	0.	0.
134028	8.81E-04	2.77E-03	6.37E-03	1.17E-02	1.93E-02	2.50E-02	0.	0.	0.	0.
134023	7.07E-04	2.60E-03	7.10E-03	1.44E-02	2.49E-02	3.66E-02	0.	0.	0.	0.
184893	2.11E-04	1.02E-03	3.28E-03	7.73E-03	1.48E-02	2.39E-02	0.	0.	0.	0.
193567	1.74E-04	9.09E-04	3.04E-03	7.61E-03	1.50E-02	2.50E-02	0.	0.	0.	0.
163082	4.59E-04	1.82E-03	5.01E-03	1.04E-02	1.85E-02	2.78E-02	0.	0.	0.	0.
148754	2.28E-04	7.99E-04	2.00E-03	3.92E-03	6.43E-03	9.18E-03	0.	0.	0.	0.
171831	1.72E-04	7.32E-04	2.12E-03	4.64E-03	8.41E-03	1.29E-02	0.	0.	0.	0.
199657	5.39E-05	2.92E-04	1.01E-03	2.56E-03	5.15E-03	8.68E-03	0.	0.	0.	0.
209029	4.30E-05	2.53E-04	9.30E-04	2.47E-03	5.15E-03	8.95E-03	0.	0.	0.	0.
179728	3.54E-05	1.63E-04	4.94E-04	1.14E-03	2.11E-03	3.33E-03	0.	0.	0.	0.
167309	1.50E-05	6.14E-05	1.73E-04	3.74E-04	6.40E-04	1.00E-03	0.	0.	0.	0.
192093	1.02E-05	5.17E-05	1.71E-04	4.16E-04	8.11E-04	1.33E-03	0.	0.	0.	0.
220000	3.19E-04	2.05E-05	8.11E-05	2.21E-04	4.94E-04	8.93E-04	0.	0.	0.	0.
228000	2.74E-04	1.91E-05	7.92E-05	2.31E-04	5.20E-04	9.42E-04	0.	0.	0.	0.
269000	1.52E-04	1.49E-05	8.04E-05	2.69E-04	7.65E-04	1.62E-03	0.	0.	0.	0.
249000	1.01E-04	8.33E-06	3.94E-05	1.28E-04	3.14E-04	6.23E-04	0.	0.	0.	0.
273000	7.17E-07	7.28E-06	4.04E-05	1.48E-04	3.98E-04	6.52E-04	0.	0.	0.	0.
301000	2.23E-07	2.80E-06	1.91E-05	6.04E-05	2.42E-04	5.89E-04	0.	0.	0.	0.
309000	1.93E-07	2.67E-06	1.87E-05	6.17E-05	2.54E-04	6.13E-04	0.	0.	0.	0.

TABLE 55. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C \*\*

STATE	LEVEL (CM-1)	STAT. WT.	TEMPERATURE (DEG K)									
			3200	3400	4000	4400	4800	5200	5600	6000	6400	
2s	0	1	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	
	52419	9	5.23E-10	7.17E-09	5.83E-08	3.24E-07	1.35E-06	4.52E-06	1.27E-05	3.13E-05	6.80E-05	
	102378	3	3.04E-20	5.10E-18	3.09E-16	8.67E-15	1.31E-13	1.58E-12	1.13E-11	6.34E-11	3.03E-10	
	137454	9	1.30E-24	1.25E-23	3.03E-21	2.72E-19	1.15E-17	2.76E-16	4.14E-15	4.34E-14	3.42E-13	
	145875	3	1.64E-28	2.39E-25	6.15E-23	9.61E-21	5.12E-19	1.40E-17	2.64E-16	3.21E-15	2.06E-14	
2p	182520	1	2.29E-36	2.09E-32	3.07E-29	1.20E-26	1.74E-24	1.17E-22	4.31E-21	9.01E-20	1.51E-18	
	240452	4	0.	0.	1.10E-37	2.89E-34	2.00E-31	5.11E-29	9.93E-27	3.64E-25	1.34E-23	
	259501	12	0.	0.	0.	1.60E-36	1.90E-33	7.37E-31	1.33E-28	1.73E-26	5.33E-25	
	271631	20	0.	0.	0.	0.	0.72E-35	4.50E-32	9.82E-30	1.03E-27	6.03E-26	
	310023	4	0.	0.	0.	0.	0.	2.23E-37	1.02E-34	2.67E-32	2.15E-30	
3s	318950	12	0.	0.	0.	0.	0.	0.	3.09E-35	7.29E-33	8.68E-31	
	322129	28	0.	0.	0.	0.	0.	0.	2.28E-35	5.67E-33	7.00E-31	
	322104	28	0.	0.	0.	0.	0.	0.	3.14E-35	7.83E-33	9.79E-31	
	3303714	12	0.	0.	0.	0.	0.	9.61E-37	4.29E-34	8.69E-32	8.67E-30	
	326459	36	0.	0.	0.	0.	0.	0.	1.35E-35	3.61E-33	6.82E-31	
3p	337058	40	0.	0.	0.	0.	0.	0.	1.47E-36	4.74E-34	7.41E-32	
	376970**	12	0.	0.	0.	0.	0.	0.	0.	0.	1.86E-36	
	383400**	24	0.	0.	0.	0.	0.	0.	0.	0.	1.33E-36	
	387400**	40	0.	0.	0.	0.	0.	0.	0.	0.	9.01E-37	
	388000**	84	0.	0.	0.	0.	0.	0.	0.	0.	1.10E-36	

\*\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTANDARD ENERGY LEVELS FROM MOORE (1949) AND BOCKASTEN (1955)

TABLE 55 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C ++

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	6800	7200	7600	8000	8400	8800	9200	9600	10000	11000
0	1.00E-00	1.00E-00	1.00E-00	9.99E-01	9.99E-01	9.99E-01	9.99E-01	9.97E-01	9.95E-01	9.91E-01
52519	1.37E-04	2.54E-04	4.41E-04	7.24E-04	1.13E-03	1.70E-03	2.47E-03	3.47E-03	4.75E-03	6.39E-03
102378	1.17E-09	3.91E-09	1.15E-08	3.02E-08	7.26E-08	1.61E-07	3.39E-07	6.49E-07	1.20E-06	2.30E-06
137454	2.11E-12	1.04E-11	4.50E-11	1.65E-10	5.34E-10	1.56E-09	4.14E-09	1.01E-08	2.31E-08	5.16E-08
149075	1.97E-13	1.09E-12	5.07E-12	2.02E-11	7.03E-11	2.19E-10	6.17E-10	1.59E-09	3.82E-09	9.34E-09
182520	1.69E-17	1.44E-16	9.85E-16	5.54E-15	2.64E-14	1.09E-13	4.00E-13	1.31E-12	3.92E-12	1.24E-11
240452	3.21E-22	5.42E-21	6.80E-20	6.62E-19	5.19E-18	3.37E-17	1.84E-16	8.91E-16	3.74E-15	1.19E-14
259501	1.71E-23	3.61E-22	5.54E-21	6.44E-20	5.94E-19	4.49E-18	2.84E-17	1.54E-16	7.28E-16	3.43E-15
271631	2.19E-24	5.34E-23	9.29E-22	1.21E-20	1.24E-19	1.03E-18	7.09E-18	4.14E-17	2.12E-16	1.41E-15
310023	1.30E-28	4.97E-27	1.50E-25	2.44E-24	3.44E-23	3.87E-22	3.50E-21	2.64E-20	1.69E-19	9.71E-18
318950	5.90E-29	2.50E-27	7.17E-26	1.47E-24	2.29E-23	2.70E-22	2.40E-21	2.00E-20	1.40E-19	9.04E-18
322129	5.01E-29	2.21E-27	6.55E-26	1.38E-24	2.10E-23	2.67E-22	2.44E-21	2.15E-20	1.43E-19	9.04E-18
322184	6.94E-29	3.04E-27	9.07E-26	1.91E-24	3.02E-23	3.71E-22	3.44E-21	2.90E-20	2.04E-19	1.30E-17
308714	5.14E-28	1.94E-26	4.93E-25	9.25E-24	1.30E-22	1.44E-21	1.29E-20	9.43E-20	6.12E-19	3.44E-17
326459	3.41E-29	1.40E-27	5.19E-26	1.14E-24	1.87E-23	2.37E-22	2.41E-21	2.02E-20	1.43E-19	9.04E-18
337058	6.39E-30	3.24E-28	1.14E-26	2.89E-25	5.07E-24	6.99E-23	7.44E-22	6.89E-21	5.10E-20	4.74E-18
374970	2.75E-34	2.31E-32	1.32E-30	4.11E-29	1.99E-27	2.70E-26	2.89E-25	3.47E-24	3.33E-23	4.00E-21
383400	2.11E-34	1.82E-32	1.04E-30	4.11E-29	1.99E-27	2.70E-26	2.89E-25	3.47E-24	3.33E-23	4.00E-21
387400	1.51E-34	1.44E-32	8.49E-31	3.34E-29	9.12E-28	1.94E-26	2.72E-25	2.44E-24	2.71E-23	3.07E-21
388000	1.40E-34	1.70E-32	1.00E-30	4.11E-29	1.99E-27	2.70E-26	2.89E-25	3.47E-24	3.33E-23	4.00E-21



TABLE 55 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C  $\leftrightarrow$

[illegible]

TABLE 55 (CONT.) 1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C II

LEVEL (CII-1)	TEMPERATURE (DEG K)									
	44000	48000	52000	56000	60000	64000	68000	72000	76000	80000
0	3.47E-01	3.08E-01	2.24E-01	1.40E-01	9.11E-02	2.10E-02	7.44E-03	5.11E-03	3.75E-03	0.
52619	5.62E-01	5.76E-01	5.73E-01	4.92E-01	3.84E-01	1.29E-01	5.59E-02	4.04E-02	3.13E-02	0.
102170	3.44E-02	4.29E-02	5.76E-02	6.67E-02	6.26E-02	3.01E-02	1.54E-02	1.20E-02	9.77E-03	0.
137654	3.49E-02	4.50E-02	7.44E-02	1.07E-01	1.13E-01	7.02E-02	4.00E-02	3.31E-02	2.77E-02	0.
145075	1.47E-02	1.94E-02	3.39E-02	5.09E-02	5.50E-02	3.07E-02	2.20E-02	1.80E-02	1.52E-02	0.
182320	0.87E-04	1.30E-03	2.01E-03	5.24E-03	6.59E-03	5.44E-03	3.84E-03	3.30E-03	2.89E-03	0.
244452	5.34E-04	9.12E-04	2.00E-03	7.43E-03	1.15E-02	1.69E-02	1.28E-02	1.13E-02	1.00E-02	0.
259501	0.59E-04	1.53E-03	5.33E-03	1.90E-02	2.61E-02	3.89E-02	5.51E-02	7.52E-02	9.60E-02	0.
271631	9.43E-04	1.70E-03	6.44E-03	2.13E-02	2.64E-02	5.94E-02	5.60E-02	5.33E-02	5.00E-02	0.
310023	5.49E-05	1.13E-04	5.29E-04	2.13E-03	4.21E-03	9.01E-03	9.76E-03	9.72E-03	9.61E-03	0.
310950	1.22E-04	2.40E-04	1.23E-03	5.43E-03	1.11E-02	2.93E-02	2.03E-02	2.05E-02	2.05E-02	0.
323120	1.96E-04	3.94E-04	1.90E-03	8.53E-03	1.77E-02	4.13E-02	4.67E-02	4.72E-02	4.72E-02	0.
323184	2.50E-04	5.51E-04	2.76E-03	1.20E-02	2.47E-02	5.70E-02	6.54E-02	6.61E-02	6.61E-02	0.
308716	1.72E-04	3.54E-04	1.64E-03	6.53E-03	1.23E-02	2.73E-02	2.94E-02	2.93E-02	2.93E-02	0.
320459	2.89E-04	6.23E-04	3.21E-03	1.42E-02	2.90E-02	7.20E-02	8.20E-02	8.41E-02	8.42E-02	0.
337050	3.40E-04	7.54E-04	4.19E-03	1.94E-02	4.20E-02	1.11E-01	1.33E-01	1.37E-01	1.39E-01	0.
376970	1.04E-03	4.57E-03	3.10E-04	1.01E-03	4.02E-03	1.67E-02	2.36E-02	2.40E-02	2.42E-02	0.
303400	4.40E-05	1.13E-04	8.19E-04	5.11E-03	1.32E-02	4.73E-02	6.75E-02	7.34E-02	7.70E-02	0.
307400	6.54E-05	1.67E-04	1.24E-03	7.93E-03	2.07E-02	7.75E-02	1.11E-01	1.21E-01	1.29E-01	0.
300000	9.00E-05	2.34E-04	1.71E-03	1.10E-02	2.60E-02	1.00E-01	1.59E-01	1.69E-01	1.69E-01	0.

TABLE 56. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF H<sup>+</sup>

STATE	LEVEL (CM <sup>-1</sup> )	STAT. WT.	TEMPERATURE (DEG K)									
			3200	3600	4000	4400	4800	5200	5600	6000	6400	
2p <sup>2</sup> 2p <sup>1</sup> 1s <sup>2</sup> 1p <sup>1</sup>	0	2	3.51E-01	3.49E-01	3.47E-01	3.44E-01	3.43E-01	3.44E-01	3.43E-01	3.42E-01	3.42E-01	
	174	4	6.49E-01	6.51E-01	6.54E-01	6.54E-01	6.57E-01	6.57E-01	6.57E-01	6.57E-01	6.56E-01	
	57203	12	1.37E-11	2.34E-10	2.34E-09	1.52E-08	7.23E-08	2.70E-07	6.56E-07	2.23E-06	5.94E-06	
	101027	10	3.29E-20	5.09E-10	2.07E-16	7.70E-15	1.22E-13	1.23E-12	9.16E-12	5.16E-11	2.34E-10	
	131004	2	9.21E-27	6.37E-24	1.19E-21	8.61E-20	3.64E-18	6.23E-17	8.20E-16	7.70E-15	5.54E-14	
2p <sup>2</sup> 2p <sup>1</sup> 1s <sup>2</sup> 1p <sup>1</sup>	145950	6	1.33E-29	6.87E-26	1.65E-23	1.95E-21	1.04E-19	2.90E-18	5.34E-17	6.40E-16	5.70E-15	
	184002	4	2.34E-37	2.63E-33	4.50E-30	2.05E-27	3.32E-25	2.44E-23	9.04E-22	2.41E-20	3.92E-19	
	203079	10	0.	9.64E-36	3.20E-32	2.60E-29	6.31E-27	6.00E-25	3.70E-23	1.22E-21	2.64E-20	
	230407	6	0.	0.	1.04E-36	1.97E-33	1.09E-30	2.12E-28	2.01E-26	1.60E-24	3.20E-23	
	221302	2	0.	0.	9.34E-36	1.25E-32	5.34E-30	8.79E-28	6.90E-26	3.67E-24	8.40E-23	
2p <sup>2</sup> 2p <sup>1</sup> 1s <sup>2</sup> 1p <sup>1</sup>	245490	6	0.	0.	0.	1.33E-35	1.07E-32	3.09E-30	3.97E-28	2.64E-26	1.04E-24	
	267242	10	0.	0.	0.	1.93E-38	2.60E-35	1.33E-32	2.60E-30	2.50E-28	1.30E-26	
	301060	2	0.	0.	0.	0.	0.	2.27E-37	8.71E-35	1.51E-32	1.37E-30	
	311700	6	0.	0.	0.	0.	0.	3.61E-34	1.71E-33	3.50E-31	3.70E-31	
	319230	24	0.	0.	0.	0.	0.	0.	9.04E-36	2.30E-33	2.70E-31	
2p <sup>2</sup> 2p <sup>1</sup> 1s <sup>2</sup> 1p <sup>1</sup>	370039	16	0.	0.	0.	0.	0.	6.20E-38	1.09E-35	1.90E-33	1.24E-31	
	316449	54	0.	0.	0.	0.	0.	1.52E-37	7.90E-35	1.40E-32	1.80E-30	
	334453	90	0.	0.	0.	0.	0.	0.	7.43E-37	2.20E-34	3.42E-32	
	304130**	200	0.	0.	0.	0.	0.	0.	0.	0.	1.54E-36	
	305000**	54	0.	0.	0.	0.	0.	0.	0.	0.	2.30E-37	
2p <sup>2</sup> 2p <sup>1</sup> 1s <sup>2</sup> 1p <sup>1</sup>	447500**	96	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	432000**	162	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	442700**	208	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	444000**	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	
2p <sup>2</sup> 2p <sup>1</sup> 1s <sup>2</sup> 1p <sup>1</sup>	55.2955	160	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	62.7468	160	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	60.9987	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	68.4375	32	0.	0.	0.	0.	0.	0.	0.	0.	0.	

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949)

TABLE 54 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N<sup>++</sup>

LEVEL (CN-1)	TEMPERATURE (DEG K)										
	6000	7000	8000	8400	8800	9200	9600	10000	11000	12000	13000
0	3.42E-01	3.41E-01	3.40E-01	3.42E-01	3.40E-01	3.39E-01	3.39E-01	3.39E-01	3.30E-01	3.37E-01	3.34E-01
174	6.58E-01	6.59E-01	6.60E-01	6.60E-01	6.60E-01	6.60E-01	6.61E-01	6.61E-01	6.61E-01	6.61E-01	6.60E-01
57283	1.12E-05	2.19E-05	6.85E-05	1.12E-04	1.74E-04	2.62E-04	3.68E-04	5.35E-04	1.13E-03	2.11E-03	3.54E-03
101027	8.89E-10	2.91E-09	8.42E-09	5.19E-08	1.14E-07	2.33E-07	4.56E-07	8.24E-07	3.26E-06	9.25E-06	2.34E-05
131004	3.13E-13	1.44E-12	1.99E-11	6.11E-11	1.49E-10	4.29E-10	1.01E-09	2.21E-09	1.22E-08	5.09E-08	1.70E-07
145950	3.97E-14	2.21E-13	4.07E-12	1.42E-11	4.41E-11	1.24E-10	3.22E-10	7.71E-10	5.19E-09	2.54E-08	9.74E-08
184802	4.67E-18	2.90E-16	1.75E-15	8.64E-15	3.70E-14	1.90E-13	4.70E-13	1.44E-12	1.44E-11	1.24E-10	7.04E-10
203079	3.73E-19	4.05E-18	3.42E-17	1.38E-16	6.44E-15	2.73E-14	1.03E-13	3.44E-13	9.92E-12	4.49E-11	2.92E-10
230407	6.89E-22	1.16E-19	1.03E-18	7.40E-18	4.44E-16	2.28E-15	1.02E-14	4.07E-15	8.27E-14	1.02E-12	9.50E-12
221302	1.50E-21	2.12E-20	1.76E-19	1.17E-17	6.56E-17	3.46E-16	1.34E-15	5.03E-15	9.07E-14	1.01E-12	7.76E-12
245690	2.72E-23	4.87E-22	6.99E-20	5.40E-19	3.65E-18	2.09E-17	1.04E-16	4.32E-16	1.12E-14	1.63E-13	1.57E-12
287242	4.74E-25	1.82E-23	2.28E-21	2.24E-20	1.79E-19	1.20E-18	6.83E-18	3.39E-17	1.11E-15	2.05E-14	2.40E-13
301046	7.35E-29	2.33E-27	5.99E-26	1.03E-24	1.42E-22	1.20E-21	8.54E-21	5.20E-20	2.44E-18	7.09E-17	1.13E-15
311708	2.33E-29	9.08E-28	2.41E-26	4.60E-25	6.61E-24	8.87E-22	5.23E-21	3.39E-20	1.99E-18	5.94E-17	1.85E-15
319238	1.69E-29	8.07E-28	4.75E-25	7.30E-24	8.75E-23	6.46E-22	4.77E-21	4.50E-20	2.90E-18	9.64E-17	1.83E-15
290839	5.70E-27	1.74E-25	3.74E-24	5.80E-23	6.82E-21	5.39E-20	3.50E-19	2.05E-18	9.14E-17	2.10E-15	3.17E-14
314449	1.17E-28	4.73E-27	1.20E-25	2.53E-24	3.73E-23	4.31E-22	3.12E-20	2.02E-19	1.25E-17	3.09E-16	6.90E-15
334445	2.85E-30	1.45E-28	4.80E-27	1.15E-25	2.73E-23	2.94E-22	2.60E-21	1.93E-20	1.53E-18	5.04E-17	1.27E-15
384130	2.40E-34	2.26E-32	1.20E-30	4.84E-29	1.30E-27	2.59E-26	4.85E-24	4.85E-22	7.34E-21	4.83E-19	1.47E-17
305000	3.84E-35	3.56E-33	2.04E-31	7.80E-30	2.11E-28	4.22E-27	7.90E-25	8.02E-24	1.23E-21	8.16E-20	2.04E-18
447900	0.	0.	2.64E-36	1.82E-34	8.40E-33	2.79E-31	1.21E-28	1.77E-27	6.14E-25	8.09E-23	5.00E-21
432000	0.	0.	8.91E-37	8.37E-35	4.99E-33	1.82E-31	5.25E-29	2.09E-27	7.90E-26	8.74E-22	4.49E-20
492700	0.	0.	0.	0.	1.09E-35	5.80E-34	1.64E-32	4.16E-31	7.97E-28	5.00E-27	1.01E-22
546000	0.	0.	0.	0.	1.02E-32	3.20E-31	7.79E-30	1.42E-28	2.04E-27	9.04E-25	5.53E-21
504100	0.	0.	0.	0.	6.12E-37	3.15E-35	1.15E-33	3.10E-32	6.44E-31	1.20E-28	1.27E-23
492000	0.	0.	0.	0.	7.71E-37	3.55E-35	1.17E-33	2.89E-32	5.31E-31	1.43E-28	6.80E-24
952000	0.	0.	0.	0.	0.	0.	1.75E-37	6.30E-36	1.75E-34	2.30E-31	1.50E-26

TABLE 54 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N++

LEVEL	TEMPERATURE (DEG K)											
	14000	15000	16000	17000	18000	19000	20000	24000	28000	32000	36000	40000
0	3.35E-01	3.34E-01	3.33E-01	3.31E-01	3.29E-01	3.27E-01	3.25E-01	3.14E-01	3.00E-01	2.84E-01	2.70E-01	2.55E-01
174	4.59E-01	4.57E-01	4.55E-01	4.53E-01	4.50E-01	4.48E-01	4.45E-01	4.21E-01	4.05E-01	3.87E-01	3.71E-01	3.57E-01
57253	5.59E-03	5.24E-03	4.84E-03	4.40E-03	3.93E-03	3.43E-03	2.90E-03	2.34E-03	1.76E-03	1.16E-03	6.44E-04	3.19E-04
101037	5.19E-05	1.03E-04	1.89E-04	3.20E-04	5.12E-04	7.79E-04	1.13E-03	1.68E-03	2.40E-03	3.34E-03	4.44E-03	5.70E-03
131004	4.77E-07	1.17E-06	2.55E-06	5.07E-06	9.33E-06	1.61E-05	2.62E-05	4.23E-05	6.50E-05	9.50E-05	1.44E-04	2.19E-04
145950	3.04E-07	8.34E-07	1.99E-06	4.29E-06	8.48E-06	1.54E-05	2.60E-05	4.06E-05	6.07E-05	8.74E-05	1.21E-04	1.62E-04
164402	3.04E-09	1.11E-08	3.37E-08	9.32E-08	2.16E-07	4.71E-07	9.40E-07	1.60E-06	2.40E-06	3.34E-06	4.44E-06	5.70E-06
203079	1.45E-09	5.80E-09	1.95E-08	5.40E-08	1.47E-07	3.43E-07	7.35E-07	1.40E-06	2.40E-06	3.34E-06	4.44E-06	5.70E-06
230407	5.24E-11	2.53E-10	1.00E-09	3.30E-09	9.22E-09	2.40E-08	6.17E-08	1.44E-07	3.40E-07	7.35E-07	1.40E-06	2.40E-06
221302	4.49E-11	2.02E-10	7.56E-10	2.43E-09	6.89E-09	1.73E-08	3.96E-08	8.43E-08	1.80E-07	3.96E-07	8.43E-07	1.80E-06
245490	1.09E-11	5.84E-11	2.54E-10	9.24E-10	2.92E-09	8.17E-09	2.04E-08	3.70E-07	2.96E-06	1.37E-05	4.41E-05	1.11E-04
267252	1.90E-12	1.23E-11	6.09E-11	2.49E-10	8.70E-10	2.40E-09	7.27E-09	1.73E-07	1.43E-06	8.32E-06	3.11E-05	8.54E-05
301048	1.22E-14	9.38E-14	5.00E-13	2.84E-12	1.60E-11	4.10E-11	1.27E-10	4.52E-09	3.73E-08	3.71E-07	3.61E-06	3.87E-05
311708	1.23E-14	1.04E-13	6.70E-13	3.47E-12	1.49E-11	5.51E-11	1.70E-10	7.22E-09	9.97E-08	7.02E-07	3.15E-06	1.69E-05
319238	2.27E-14	2.02E-13	1.34E-12	7.33E-12	3.27E-11	1.25E-10	4.14E-10	1.44E-08	2.71E-07	2.00E-06	9.38E-06	3.14E-05
290839	3.15E-13	2.31E-12	1.31E-11	6.00E-11	2.30E-10	8.02E-10	2.40E-09	7.57E-08	6.74E-07	5.30E-06	2.18E-05	6.30E-05
314449	8.34E-14	7.10E-13	4.71E-12	2.47E-11	1.00E-10	4.03E-10	1.32E-09	5.51E-08	7.79E-07	5.50E-06	2.94E-05	6.44E-05
334445	1.70E-14	1.70E-13	1.30E-12	7.09E-12	3.44E-11	1.40E-10	5.20E-10	2.77E-09	4.45E-07	3.79E-06	1.91E-05	6.02E-05
304130	3.44E-16	4.70E-15	6.77E-14	3.42E-13	2.19E-12	1.10E-11	4.67E-11	4.51E-09	1.14E-07	1.30E-06	8.37E-06	3.47E-05
305000	5.93E-17	8.27E-16	8.20E-15	4.31E-14	3.04E-13	1.93E-12	8.22E-12	8.02E-10	2.00E-08	2.34E-07	1.52E-06	6.47E-06
447500	1.71E-19	3.64E-18	5.33E-17	5.64E-16	4.62E-15	3.01E-14	1.63E-13	3.37E-11	1.49E-09	2.80E-08	2.22E-07	1.25E-06
432000	1.42E-18	2.73E-17	3.63E-16	3.55E-15	2.69E-14	1.65E-13	8.39E-13	1.44E-11	5.54E-09	8.40E-08	6.92E-07	3.60E-06
492700	4.94E-21	1.44E-19	2.75E-18	3.70E-17	3.74E-16	2.95E-15	1.89E-14	6.72E-12	4.37E-10	6.04E-09	1.09E-07	7.39E-07
444000	1.87E-19	3.94E-18	5.72E-17	6.03E-16	4.08E-15	3.17E-14	1.70E-13	3.45E-11	2.51E-09	2.21E-08	2.21E-07	1.24E-06
504100	6.92E-22	2.21E-20	4.51E-19	6.42E-18	7.11E-17	5.94E-16	4.01E-15	1.67E-12	1.22E-10	2.99E-09	3.55E-08	2.54E-07
492000	3.32E-22	9.42E-21	1.83E-19	2.46E-18	2.47E-17	1.94E-16	1.24E-15	4.38E-13	2.63E-11	6.34E-10	7.02E-09	4.74E-08
552000	1.24E-24	5.41E-23	1.47E-21	2.72E-20	3.63E-19	3.40E-18	2.95E-17	2.13E-14	2.31E-12	7.40E-11	1.13E-09	9.70E-08

TABLE 56 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N<sup>++</sup>

LEVEL (CM <sup>-1</sup> )	TEMPERATURE (DEG K)										0	0	0	0
	44000	48000	60000	80000	100000	200000	400000	600000	1000000	1800000				
0	2.41E-01	2.27E-01	1.40E-01	1.39E-01	9.09E-02	2.04E-02	5.80E-03	3.64E-03	2.49E-03	0.	0.	0.	0.	0.
174	2.79E-01	4.52E-01	2.79E-01	2.78E-01	1.99E-01	6.07E-02	1.14E-02	7.28E-03	4.94E-03	0.	0.	0.	0.	0.
57283	2.42E-01	2.43E-01	2.09E-01	2.07E-01	1.50E-01	8.09E-02	2.83E-02	1.91E-02	1.37E-02	0.	0.	0.	0.	0.
101027	4.43E-02	5.50E-02	1.13E-01	1.13E-01	1.14E-01	4.92E-02	2.02E-02	1.33E-02	1.07E-02	0.	0.	0.	0.	0.
131804	3.32E-03	4.40E-03	8.23E-03	1.32E-02	1.49E-02	7.94E-03	3.62E-03	2.04E-03	2.04E-03	0.	0.	0.	0.	0.
149950	6.11E-03	8.50E-03	1.73E-02	3.01E-02	3.60E-02	2.14E-02	1.03E-02	7.78E-03	6.04E-03	0.	0.	0.	0.	0.
104402	1.07E-03	1.60E-03	4.32E-03	9.69E-03	1.33E-02	1.04E-02	5.92E-03	4.63E-03	3.80E-03	0.	0.	0.	0.	0.
203079	1.97E-03	2.50E-03	7.31E-03	1.81E-02	2.44E-02	2.34E-02	1.40E-02	1.12E-02	9.27E-03	0.	0.	0.	0.	0.
230407	3.84E-04	6.82E-04	2.28E-03	6.63E-03	1.07E-02	1.16E-02	7.59E-03	6.19E-03	5.35E-03	0.	0.	0.	0.	0.
221302	1.77E-04	2.99E-04	9.44E-04	2.60E-03	4.04E-03	4.14E-03	2.62E-03	2.14E-03	1.81E-03	0.	0.	0.	0.	0.
243690	2.34E-04	4.32E-04	1.58E-03	5.04E-03	8.57E-03	1.04E-02	7.19E-03	6.04E-03	5.23E-03	0.	0.	0.	0.	0.
267242	1.93E-04	3.77E-04	1.57E-03	5.78E-03	1.05E-02	1.49E-02	1.11E-02	9.60E-03	8.43E-03	0.	0.	0.	0.	0.
301000	1.25E-05	2.73E-05	1.39E-04	6.20E-04	1.29E-03	2.33E-03	1.96E-03	1.77E-03	1.61E-03	0.	0.	0.	0.	0.
311708	2.71E-05	5.97E-05	3.24E-04	1.54E-03	3.31E-03	6.49E-03	5.67E-03	5.10E-03	4.70E-03	0.	0.	0.	0.	0.
319236	8.44E-05	1.90E-04	1.00E-03	5.37E-03	1.19E-02	2.44E-02	2.21E-02	2.53E-02	1.80E-02	0.	0.	0.	0.	0.
290039	1.61E-04	3.35E-04	1.60E-03	6.71E-03	1.44E-02	2.24E-02	1.83E-02	1.63E-02	1.47E-02	0.	0.	0.	0.	0.
314449	2.23E-04	4.95E-04	2.73E-03	1.32E-02	2.87E-02	5.73E-02	5.05E-02	4.63E-02	4.24E-02	0.	0.	0.	0.	0.
314445	1.93E-04	4.53E-04	2.62E-03	1.53E-02	3.50E-02	8.24E-02	7.04E-02	7.33E-02	6.91E-02	0.	0.	0.	0.	0.
304130	1.27E-04	3.27E-04	2.14E-03	2.01E-02	5.61E-02	1.85E-02	2.10E-01	2.09E-01	2.04E-01	0.	0.	0.	0.	0.
305000	2.22E-05	5.97E-05	5.03E-04	3.70E-03	1.04E-02	3.45E-02	3.92E-02	3.91E-02	3.85E-02	0.	0.	0.	0.	0.
447500	5.10E-06	1.63E-05	2.00E-04	2.14E-03	7.52E-03	3.91E-02	5.57E-02	5.90E-02	6.24E-02	0.	0.	0.	0.	0.
432000	1.43E-05	4.30E-05	4.89E-04	4.77E-03	1.59E-02	7.37E-02	9.93E-02	1.05E-01	1.08E-01	0.	0.	0.	0.	0.
492700	3.49E-06	1.24E-05	2.03E-04	2.89E-03	1.10E-02	8.47E-02	1.42E-01	1.61E-01	1.70E-01	0.	0.	0.	0.	0.
444000	5.03E-06	1.60E-05	1.94E-04	2.04E-03	7.20E-03	3.70E-02	5.23E-02	5.93E-02	5.80E-02	0.	0.	0.	0.	0.
506100	1.25E-06	4.60E-06	8.17E-05	1.24E-03	5.39E-03	4.27E-02	7.51E-02	8.44E-02	9.59E-02	0.	0.	0.	0.	0.
492000	2.23E-07	8.05E-07	1.29E-05	1.80E-04	7.43E-04	5.32E-03	8.60E-03	1.01E-02	1.10E-02	0.	0.	0.	0.	0.
552000	5.58E-08	2.37E-07	5.43E-06	1.09E-04	5.57E-04	6.14E-03	1.27E-02	1.55E-02	1.80E-02	0.	0.	0.	0.	0.

TABLE 57. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O++

STATE	LEVEL (CM-1)	STAT. WT.	TEMPERATURE (DEG K)									
			3200	3400	4000	4400	4800	5200	5600	6000	6400	
2s 2p <sup>3</sup> P <sup>o</sup>	0	1	1.42E-01	1.21E-01	1.20E-01	1.19E-01	1.18E-01	1.17E-01	1.17E-01	1.16E-01	1.16E-01	
	1	3	3.47E-01	3.44E-01	3.44E-01	3.43E-01	3.42E-01	3.41E-01	3.40E-01	3.39E-01	3.38E-01	
	2	5	5.31E-01	5.33E-01	5.34E-01	5.35E-01	5.36E-01	5.37E-01	5.40E-01	5.40E-01	5.40E-01	
	3	5	6.70E-05	1.83E-04	4.07E-04	7.84E-04	1.35E-03	2.15E-03	3.19E-03	4.50E-03	6.07E-03	
	4	5	4.30E-10	3.89E-09	2.14E-08	8.74E-08	2.82E-07	7.59E-07	1.77E-06	3.70E-06	7.03E-06	
2s 2p <sup>1</sup> P <sup>o</sup>	0	3	1.02E-12	2.05E-11	2.27E-10	1.62E-09	8.31E-09	3.32E-08	1.09E-07	3.04E-07	7.48E-07	
	1	15	6.63E-24	2.64E-21	3.17E-19	1.60E-17	4.10E-16	6.62E-15	7.07E-14	5.50E-13	3.51E-12	
	2	9	1.73E-28	2.10E-25	6.16E-23	6.43E-21	3.10E-19	8.21E-18	1.34E-16	1.59E-15	1.51E-14	
	3	3	0.	2.24E-35	5.95E-32	3.63E-29	7.81E-27	7.31E-25	5.97E-23	1.04E-21	1.99E-20	
	4	5	1.82E-37	2.06E-33	3.61E-30	1.62E-27	2.64E-25	1.96E-23	7.89E-22	1.93E-20	3.16E-19	
2p <sup>3</sup> P	0	3	210459	25.09E9	36.94E21	4.61E-31	1.42E-28	1.81E-26	1.19E-24	4.21E-23	9.83E-22	
	1	9	283866	35.14E0	60.57E8	0.	1.10E-37	8.19E-35	2.23E-32	2.04E-30	2.01E-28	
	2	9	298289	36.98E2	44.31E8	0.	0.	0.	3.04E-34	5.01E-32	4.54E-30	
	3	3	343303	42.56E0	0.	0.	0.	0.	0.	4.09E-37	3.51E-35	
	4	12	268899	33.33E4	0.	0.	9.26E-39	1.40E-35	6.86E-33	1.30E-30	7.74E-27	
2s 2p <sup>1</sup> P	0	3	380000	47.11E8	0.	0.	0.	0.	0.	0.	0.	
	1	3	343043	42.53E8	0.	0.	0.	0.	0.	0.	0.	
	2	3	370399	45.92E4	0.	0.	0.	0.	0.	0.	0.	
	3	3	398904	49.45E5	0.	0.	0.	0.	0.	0.	0.	
	4	4	448160	55.56E3	0.	0.	0.	0.	0.	0.	0.	
2s 2p <sup>3</sup> P <sup>o</sup>	0	20	49.43E2	0.	0.	0.	0.	0.	0.	0.	0.	
	1	60	52.69E9	0.	0.	0.	0.	0.	0.	0.	0.	
	2	100	56.28E7	0.	0.	0.	0.	0.	0.	0.	0.	
	3	320	62.36E4	0.	0.	0.	0.	0.	0.	0.	0.	
	4	108	60.87E7	0.	0.	0.	0.	0.	0.	0.	0.	
2s 2p <sup>1</sup> P <sup>o</sup>	0	192	69.15E4	0.	0.	0.	0.	0.	0.	0.	0.	
	1	36	58.89E0	0.	0.	0.	0.	0.	0.	0.	0.	
	2	64	66.94E7	0.	0.	0.	0.	0.	0.	0.	0.	
	3	72	67.19E7	0.	0.	0.	0.	0.	0.	0.	0.	
	4	128	75.25E5	0.	0.	0.	0.	0.	0.	0.	0.	
2p <sup>3</sup> P	0	180	70.17E2	0.	0.	0.	0.	0.	0.	0.	0.	
	1	320	78.23E0	0.	0.	0.	0.	0.	0.	0.	0.	
	2	108	74.38E6	0.	0.	0.	0.	0.	0.	0.	0.	
	3	192	82.44E4	0.	0.	0.	0.	0.	0.	0.	0.	
	4	0	0.	0.	0.	0.	0.	0.	0.	0.	0.	

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949) AND BOWEN (1955)

TABLE 57 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O++

LEVEL	TEMPERATURE (DEG K)											
	6000	7200	7400	8000	8400	8800	9200	9600	10000	11000	12000	13000
1CM-1)												
0	1.13E-01	1.13E-01	1.14E-01	1.13E-01	1.13E-01	1.13E-01	1.12E-01	1.12E-01	1.11E-01	1.10E-01	1.08E-01	1.07E-01
113	3.37E-01	3.35E-01	3.36E-01	3.33E-01	3.33E-01	3.32E-01	3.30E-01	3.29E-01	3.28E-01	3.24E-01	3.21E-01	3.17E-01
304	5.40E-01	5.39E-01	5.38E-01	5.37E-01	5.36E-01	5.35E-01	5.34E-01	5.33E-01	5.31E-01	5.27E-01	5.22E-01	5.17E-01
20274	7.89E-03	7.87E-03	7.85E-03	7.83E-03	7.81E-03	7.79E-03	7.77E-03	7.75E-03	7.73E-03	7.71E-03	7.69E-03	7.67E-03
43187	1.24E-05	1.23E-05	1.22E-05	1.21E-05	1.20E-05	1.19E-05	1.18E-05	1.17E-05	1.16E-05	1.15E-05	1.14E-05	1.13E-05
40312	1.45E-06	1.44E-06	1.43E-06	1.42E-06	1.41E-06	1.40E-06	1.39E-06	1.38E-06	1.37E-06	1.36E-06	1.35E-06	1.34E-06
170041	1.61E-11	1.60E-11	1.59E-11	1.58E-11	1.57E-11	1.56E-11	1.55E-11	1.54E-11	1.53E-11	1.52E-11	1.51E-11	1.50E-11
162304	8.55E-14	8.54E-14	8.53E-14	8.52E-14	8.51E-14	8.50E-14	8.49E-14	8.48E-14	8.47E-14	8.46E-14	8.45E-14	8.44E-14
170707	2.48E-19	2.47E-19	2.46E-19	2.45E-19	2.44E-19	2.43E-19	2.42E-19	2.41E-19	2.40E-19	2.39E-19	2.38E-19	2.37E-19
107049	3.73E-18	3.72E-18	3.71E-18	3.70E-18	3.69E-18	3.68E-18	3.67E-18	3.66E-18	3.65E-18	3.64E-18	3.63E-18	3.62E-18
210459	1.50E-20	1.49E-20	1.48E-20	1.47E-20	1.46E-20	1.45E-20	1.44E-20	1.43E-20	1.42E-20	1.41E-20	1.40E-20	1.39E-20
203666	8.53E-27	8.52E-27	8.51E-27	8.50E-27	8.49E-27	8.48E-27	8.47E-27	8.46E-27	8.45E-27	8.44E-27	8.43E-27	8.42E-27
208239	7.24E-28	7.23E-28	7.22E-28	7.21E-28	7.20E-28	7.19E-28	7.18E-28	7.17E-28	7.16E-28	7.15E-28	7.14E-28	7.13E-28
343303	1.70E-33	1.69E-33	1.68E-33	1.67E-33	1.66E-33	1.65E-33	1.64E-33	1.63E-33	1.62E-33	1.61E-33	1.60E-33	1.59E-33
268899	2.70E-25	2.69E-25	2.68E-25	2.67E-25	2.66E-25	2.65E-25	2.64E-25	2.63E-25	2.62E-25	2.61E-25	2.60E-25	2.59E-25
207960	1.73E-27	1.72E-27	1.71E-27	1.70E-27	1.69E-27	1.68E-27	1.67E-27	1.66E-27	1.65E-27	1.64E-27	1.63E-27	1.62E-27
327307	5.70E-30	5.69E-30	5.68E-30	5.67E-30	5.66E-30	5.65E-30	5.64E-30	5.63E-30	5.62E-30	5.61E-30	5.60E-30	5.59E-30
287400	1.99E-33	1.98E-33	1.97E-33	1.96E-33	1.95E-33	1.94E-33	1.93E-33	1.92E-33	1.91E-33	1.90E-33	1.89E-33	1.88E-33
388411	5.81E-34	5.80E-34	5.79E-34	5.78E-34	5.77E-34	5.76E-34	5.75E-34	5.74E-34	5.73E-34	5.72E-34	5.71E-34	5.70E-34
379062	1.02E-34	1.01E-34	1.00E-34	9.99E-35	9.98E-35	9.97E-35	9.96E-35	9.95E-35	9.94E-35	9.93E-35	9.92E-35	9.91E-35
380000	1.17E-34	1.16E-34	1.15E-34	1.14E-34	1.13E-34	1.12E-34	1.11E-34	1.10E-34	1.09E-34	1.08E-34	1.07E-34	1.06E-34
343043	8.30E-32	8.29E-32	8.28E-32	8.27E-32	8.26E-32	8.25E-32	8.24E-32	8.23E-32	8.22E-32	8.21E-32	8.20E-32	8.19E-32
370399	7.63E-34	7.62E-34	7.61E-34	7.60E-34	7.59E-34	7.58E-34	7.57E-34	7.56E-34	7.55E-34	7.54E-34	7.53E-34	7.52E-34
368904	3.05E-36	3.04E-36	3.03E-36	3.02E-36	3.01E-36	3.00E-36	2.99E-36	2.98E-36	2.97E-36	2.96E-36	2.95E-36	2.94E-36
440160	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
398700	5.31E-37	5.30E-37	5.29E-37	5.28E-37	5.27E-37	5.26E-37	5.25E-37	5.24E-37	5.23E-37	5.22E-37	5.21E-37	5.20E-37
425000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
454000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
503000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
491000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
537000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
475000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
540000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
542000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
607000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
544000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
631000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
600000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
645000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.



TABLE 57 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ga+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	14000	15000	16000	17000	18000	19000	20000	24000	28000	32000
0	1.04E-01	1.05E-01	1.03E-01	1.02E-01	1.01E-01	9.97E-02	9.84E-02	9.44E-02	8.66E-02	7.71E-02
113	3.14E-01	3.10E-01	3.07E-01	3.03E-01	3.00E-01	2.97E-01	2.93E-01	2.81E-01	2.68E-01	2.54E-01
304	5.12E-01	5.07E-01	5.02E-01	4.97E-01	4.92E-01	4.87E-01	4.82E-01	4.63E-01	4.44E-01	4.25E-01
20274	6.58E-02	7.47E-02	8.34E-02	9.17E-02	9.92E-02	1.07E-01	1.15E-01	1.40E-01	1.68E-01	1.98E-01
43187	1.25E-03	1.64E-03	2.12E-03	2.64E-03	3.20E-03	3.79E-03	4.41E-03	7.09E-03	9.85E-03	1.25E-02
60312	1.08E-02	1.41E-02	1.78E-02	2.19E-02	2.64E-02	3.12E-02	3.63E-02	1.27E-02	2.04E-02	2.89E-02
120041	6.96E-04	1.57E-04	3.18E-04	5.42E-04	8.03E-04	1.09E-03	1.40E-03	1.04E-03	1.41E-03	1.81E-03
182384	4.20E-07	1.10E-06	2.94E-06	5.14E-06	8.94E-06	1.34E-05	1.84E-05	1.67E-05	1.30E-05	1.02E-05
197087	5.07E-10	1.97E-09	6.22E-09	1.74E-08	4.34E-08	9.87E-08	2.04E-07	2.09E-07	9.54E-07	2.02E-06
197089	2.37E-09	8.44E-09	2.56E-08	8.80E-08	1.42E-07	3.53E-07	7.68E-07	6.37E-06	3.83E-05	1.83E-04
210459	1.28E-10	5.36E-10	1.87E-09	5.63E-09	1.50E-08	3.50E-08	7.84E-08	9.39E-07	5.44E-06	2.83E-05
283846	2.04E-13	1.41E-12	7.62E-12	3.33E-11	1.27E-10	4.14E-10	1.20E-09	3.77E-07	2.44E-06	9.92E-06
298289	2.57E-14	1.94E-13	1.16E-12	5.94E-12	2.23E-11	7.72E-11	2.34E-10	8.04E-09	9.98E-08	6.52E-07
343303	5.03E-17	5.22E-16	4.04E-15	2.46E-14	1.22E-13	5.11E-13	1.83E-12	1.09E-10	1.72E-09	1.72E-08
248899	1.24E-12	7.88E-12	3.91E-11	1.60E-10	5.60E-10	1.72E-09	4.70E-09	1.13E-07	1.08E-06	5.64E-06
297946	1.91E-13	1.44E-12	8.59E-12	4.10E-11	1.45E-10	5.70E-10	1.74E-09	5.94E-08	7.31E-07	4.76E-06
337307	1.56E-14	1.45E-13	1.02E-12	5.71E-12	2.63E-11	1.03E-10	3.52E-10	1.70E-08	2.70E-07	2.12E-06
337400	1.42E-16	1.62E-15	1.37E-14	8.94E-14	4.74E-13	2.11E-12	8.07E-12	5.61E-10	1.15E-08	1.10E-07
348411	1.37E-16	1.69E-15	1.32E-14	1.04E-13	5.90E-13	2.79E-12	1.10E-11	8.70E-10	1.94E-08	2.01E-07
379042	7.45E-17	1.02E-15	9.74E-15	7.15E-14	4.20E-13	2.04E-12	8.49E-12	7.65E-10	1.89E-08	2.07E-07
380000	9.73E-17	1.30E-15	1.25E-14	9.24E-14	5.45E-13	2.67E-12	1.11E-11	1.01E-09	2.52E-08	2.78E-07
343043	1.24E-15	1.29E-14	9.93E-14	6.03E-13	2.99E-12	1.29E-11	4.53E-11	2.64E-09	4.81E-08	4.18E-07
370399	2.24E-16	2.80E-15	2.55E-14	1.78E-13	1.01E-12	4.79E-12	1.90E-11	1.34E-09	3.33E-08	3.17E-07
398904	1.99E-17	3.03E-16	3.27E-15	2.67E-14	1.72E-13	9.10E-13	4.64E-12	1.36E-09	1.36E-08	1.70E-07
448160	4.04E-19	8.60E-18	1.25E-16	1.32E-15	1.07E-14	6.99E-14	3.77E-13	7.78E-11	3.87E-09	5.93E-08
398700	3.39E-18	5.15E-17	5.55E-16	4.32E-15	2.91E-14	1.54E-13	6.80E-13	7.64E-11	2.39E-09	2.85E-08
425000	6.82E-17	1.24E-16	1.56E-16	1.46E-15	1.07E-14	6.31E-14	3.12E-13	4.87E-11	1.78E-09	2.62E-08
454000	5.77E-20	1.20E-18	1.92E-17	2.10E-16	1.79E-15	1.17E-14	6.45E-14	1.43E-11	4.69E-10	1.19E-08
503000	1.20E-21	3.72E-20	7.50E-19	1.06E-17	1.12E-16	9.12E-16	6.08E-15	2.42E-12	1.73E-10	4.98E-09
491000	1.39E-21	3.97E-20	7.45E-19	9.88E-18	9.83E-17	7.67E-16	4.84E-15	1.60E-12	1.00E-10	2.43E-09
557000	2.80E-24	1.24E-22	3.50E-21	6.59E-20	8.94E-19	9.20E-18	7.50E-17	5.71E-14	4.44E-12	2.22E-10
475000	2.40E-21	6.14E-20	1.05E-18	1.28E-17	1.10E-16	6.50E-16	3.13E-15	1.44E-12	8.19E-11	1.64E-09
540000	5.34E-24	2.14E-23	5.38E-21	9.24E-20	1.16E-18	1.11E-17	8.49E-17	5.27E-14	5.14E-12	1.59E-10
542000	4.91E-24	1.99E-23	5.04E-21	8.79E-20	1.11E-18	1.07E-17	5.24E-16	5.23E-14	2.34E-12	1.64E-10
607000	1.10E-26	6.92E-25	2.60E-23	6.38E-22	1.09E-20	1.39E-19	1.37E-18	1.90E-15	3.30E-13	1.54E-11
546000	1.04E-24	4.97E-23	1.44E-21	2.88E-20	4.08E-19	4.34E-18	3.68E-17	3.12E-14	3.81E-12	1.39E-10
631000	2.32E-27	1.73E-25	7.52E-24	2.09E-22	3.65E-21	5.65E-20	6.09E-19	1.13E-15	2.40E-13	1.32E-11
600000	1.90E-26	1.14E-24	4.12E-23	9.74E-22	1.62E-21	1.98E-20	1.91E-18	2.44E-15	3.99E-13	1.81E-11
645000	4.24E-29	3.98E-27	2.12E-25	7.07E-24	1.59E-22	2.58E-21	3.17E-20	8.80E-17	2.51E-14	1.73E-12
										4.61E-11
										6.34E-10

TABLE 57 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O++

LEVEL (CM-1)	TEMPERATURE (DEG F)									
	44000	48000	52000	56000	60000	64000	68000	72000	76000	80000
0	7.77E-02	7.49E-02	6.89E-02	5.38E-02	4.05E-02	8.12E-03	1.92E-03	1.11E-03	7.04E-04	0.
113	2.24E-01	2.24E-01	2.00E-01	1.61E-01	1.21E-01	2.43E-02	5.35E-03	3.23E-03	2.22E-03	0.
306	3.85E-01	3.71E-01	3.32E-01	2.62E-01	2.02E-01	4.58E-02	9.58E-03	5.35E-03	3.23E-03	0.
20274	2.00E-01	2.04E-01	2.06E-01	1.87E-01	1.51E-01	3.51E-02	6.91E-03	5.29E-03	3.43E-03	0.
43187	1.89E-02	2.05E-02	2.37E-02	2.47E-02	2.18E-02	5.51E-03	1.64E-03	1.00E-03	6.63E-04	0.
60312	5.41E-02	6.14E-02	7.87E-02	9.09E-02	8.50E-02	2.63E-02	7.72E-03	4.81E-03	3.24E-03	0.
128041	2.30E-02	3.06E-02	5.64E-02	9.31E-02	1.08E-01	5.14E-02	1.87E-02	1.25E-02	8.91E-03	0.
142384	6.65E-03	9.65E-03	3.74E-02	3.74E-02	4.70E-02	2.62E-02	1.03E-02	7.11E-03	5.18E-03	0.
197809	3.71E-04	6.11E-04	1.78E-03	6.64E-03	7.13E-03	5.90E-03	2.83E-03	2.08E-03	1.59E-03	0.
187049	8.58E-04	1.39E-03	3.77E-03	9.30E-03	1.37E-02	1.06E-02	4.89E-03	3.59E-03	2.70E-03	0.
210499	2.39E-04	4.09E-04	1.29E-03	3.64E-03	5.80E-03	5.34E-03	2.70E-03	2.01E-03	1.54E-03	0.
327307	1.85E-04	2.44E-04	1.57E-03	2.93E-03	6.14E-03	9.69E-03	6.22E-03	5.04E-03	4.22E-03	0.
298239	2.51E-05	4.90E-05	2.42E-04	1.24E-03	2.77E-03	4.75E-03	3.28E-03	2.72E-03	2.30E-03	0.
343303	1.04E-04	2.54E-04	1.78E-03	1.12E-03	2.90E-04	6.87E-04	5.58E-04	4.88E-04	4.31E-04	0.
248699	1.42E-04	2.84E-04	1.27E-03	5.12E-03	1.01E-02	1.41E-02	8.75E-03	7.00E-03	5.75E-03	0.
397864	1.64E-04	3.54E-04	1.90E-03	9.11E-03	2.00E-02	3.43E-02	2.34E-02	1.94E-02	1.65E-02	0.
327307	1.85E-04	2.44E-04	1.57E-03	2.93E-03	6.14E-03	9.69E-03	6.22E-03	5.04E-03	4.22E-03	0.
337400	7.84E-04	2.00E-03	1.52E-03	1.04E-03	7.64E-03	7.55E-03	6.34E-03	5.44E-03	5.04E-03	0.
348411	1.84E-03	4.31E-03	3.21E-04	2.57E-03	7.27E-03	2.07E-02	1.89E-02	1.45E-02	1.50E-02	0.
379062	1.53E-05	5.22E-05	4.53E-03	5.33E-03	1.04E-02	3.19E-02	2.94E-02	2.69E-02	2.45E-02	0.
365000	2.42E-05	7.11E-05	4.20E-04	8.44E-03	1.44E-02	4.43E-02	4.11E-02	3.75E-02	3.43E-02	0.
253043	2.51E-05	6.15E-05	4.29E-04	2.70E-03	6.99E-03	1.55E-02	1.34E-02	1.17E-02	1.03E-02	0.
370399	3.07E-05	8.13E-05	6.68E-04	4.92E-03	1.41E-02	4.07E-02	3.64E-02	3.29E-02	2.98E-02	0.
369904	2.02E-05	5.77E-05	5.62E-04	4.94E-03	1.56E-02	5.33E-02	5.48E-02	5.12E-02	4.77E-02	0.
448160	1.29E-05	4.21E-05	5.52E-04	6.52E-03	2.46E-02	1.24E-01	1.47E-01	1.44E-01	1.42E-01	0.
398700	3.39E-04	9.67E-04	9.42E-03	8.27E-04	2.61E-03	9.23E-03	9.14E-03	8.54E-03	7.99E-03	0.
423000	4.30E-04	1.32E-03	1.50E-03	1.53E-03	5.37E-03	2.49E-02	2.41E-02	2.30E-02	2.30E-02	0.
424000	2.77E-04	9.21E-04	1.25E-04	1.53E-03	5.90E-03	3.10E-02	3.75E-02	3.74E-02	3.67E-02	0.
503000	1.79E-04	6.79E-04	1.24E-04	2.03E-03	9.32E-03	6.97E-02	1.09E-01	1.04E-01	1.19E-01	0.
491000	8.94E-07	3.28E-06	5.54E-05	8.49E-04	3.74E-03	2.57E-02	3.54E-02	3.70E-02	3.74E-02	0.
557000	1.64E-07	8.07E-07	2.93E-05	4.60E-04	2.57E-03	2.84E-02	4.74E-02	5.61E-02	6.06E-02	0.
479000	5.03E-07	1.77E-06	2.72E-05	3.77E-04	1.57E-03	9.99E-03	1.25E-02	1.28E-02	1.28E-02	0.
540000	1.07E-07	4.54E-07	1.02E-05	2.08E-04	1.10E-03	1.07E-02	1.74E-02	1.92E-02	2.08E-02	0.
542000	1.12E-07	4.74E-07	1.09E-05	2.24E-04	1.20E-03	1.18E-02	1.94E-02	2.18E-02	2.33E-02	0.
607000	2.39E-08	1.20E-07	4.03E-06	1.23E-04	8.35E-04	1.32E-02	2.78E-02	3.32E-02	3.77E-02	0.
544000	1.20E-07	5.70E-07	1.53E-05	3.67E-04	2.12E-03	2.49E-02	4.51E-02	5.15E-02	5.62E-02	0.
631000	2.72E-08	1.46E-07	5.74E-06	2.03E-04	1.48E-03	2.78E-02	6.34E-02	7.82E-02	9.11E-02	0.
609000	2.59E-08	1.25E-07	4.07E-06	1.20E-04	7.79E-04	1.17E-02	2.35E-02	2.82E-02	3.21E-02	0.
645000	3.37E-09	3.17E-08	1.52E-06	6.60E-05	5.44E-04	1.50E-02	3.31E-02	4.33E-02	5.20E-02	0.

TABLE 36. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR<sup>++</sup>

STATE	LEVEL (CM-1)	STAT. WT.	TEMPERATURE (DEG K)									
			3200	3600	4000	4400	4800	5200	5600	6000	6400	
3s <sup>2</sup> 3p <sup>2</sup> 1s <sup>2</sup>	0	5	6.83E-01	6.69E-01	6.57E-01	6.44E-01	6.37E-01	6.28E-01	6.20E-01	6.13E-01	6.06E-01	
	1112	3	2.48E-01	2.57E-01	2.64E-01	2.70E-01	2.74E-01	2.77E-01	2.80E-01	2.82E-01	2.83E-01	
	1370	1	6.74E-02	7.14E-02	7.47E-02	7.74E-02	7.94E-02	8.14E-02	8.3E-02	8.41E-02	8.51E-02	
	14010	5	1.25E-03	2.77E-03	4.72E-03	6.62E-03	9.38E-03	1.30E-02	1.70E-02	2.13E-02	2.60E-02	
	33266	1	4.36E-08	2.25E-07	8.35E-07	2.44E-06	5.95E-06	1.26E-05	2.41E-05	4.21E-05	6.89E-05	
3s 3p <sup>3</sup> 1s <sup>2</sup>	114503	9	5.89E-23	1.74E-20	1.65E-18	6.81E-17	1.51E-15	2.08E-14	1.97E-13	1.80E-12	1.55E-12	
	144023	3	3.08E-29	4.03E-26	1.25E-23	1.37E-21	6.82E-20	1.86E-18	3.17E-17	5.69E-16	9.15E-15	
	169413	40	3.69E-29	6.23E-26	2.40E-23	3.13E-21	1.81E-19	5.59E-18	1.04E-16	1.59E-15	1.25E-14	
3s <sup>2</sup> 3p <sup>2</sup> (5s) 3d	176739	8	3.34E-35	2.25E-31	2.58E-28	6.23E-26	1.00E-23	5.81E-22	1.09E-20	3.85E-19	5.30E-18	
	206368	24	0.	4.86E-36	1.82E-32	1.53E-29	4.17E-27	4.80E-25	2.80E-23	9.48E-22	2.07E-20	
	248377	40	0.	0.	0.	2.76E-35	2.36E-32	7.16E-30	9.58E-28	6.66E-26	2.72E-24	
	263000	56	0.	0.	0.	3.24E-37	4.13E-34	1.75E-31	3.13E-29	2.80E-27	1.42E-25	
(D <sup>+</sup> ) 3d	180000	100	2.64E-36	3.12E-32	5.63E-29	2.59E-26	4.28E-24	3.22E-22	1.31E-20	3.23E-19	5.33E-18	
	197480	20	0.	1.41E-34	3.72E-31	2.33E-28	4.98E-26	4.60E-24	2.79E-22	6.66E-21	1.27E-19	
	226800	60	0.	0.	2.93E-35	4.80E-32	2.28E-29	4.21E-27	3.67E-25	1.77E-23	5.22E-22	
	248600	100	0.	0.	0.	6.68E-38	1.30E-34	4.29E-32	1.26E-29	1.24E-27	6.91E-26	
(F <sup>+</sup> ) 3d	284000	140	0.	0.	0.	0.	1.91E-34	1.31E-33	3.53E-31	4.55E-29	3.17E-27	
	214000	60	0.	5.76E-37	2.93E-33	3.15E-30	1.04E-27	1.45E-25	9.85E-24	3.80E-22	9.29E-21	
	208000	12	0.	1.27E-36	5.97E-33	4.49E-30	1.20E-27	1.53E-25	4.20E-24	3.31E-22	1.16E-21	
	241500	36	0.	0.	8.89E-38	2.35E-34	1.67E-31	4.32E-29	5.05E-27	3.12E-25	1.15E-23	
4d	282000	60	0.	0.	0.	0.	1.49E-36	9.79E-34	2.55E-31	3.15E-29	2.13E-27	
	298000	84	0.	0.	0.	0.	0.	1.64E-35	5.84E-33	9.51E-31	6.18E-29	

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTANDARD ENERGY LEVELS FROM MOORE (1949) AND BOWEN (1955,1960)

TABLE 58 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ar<sup>++</sup>

LEVEL (CM <sup>-1</sup> )	TEMPERATURE (DEG K)									
	6000	7200	7600	8000	8400	8800	9200	9600	10000	11000
0	5.99E-01	5.93E-01	5.86E-01	5.80E-01	5.75E-01	5.69E-01	5.64E-01	5.59E-01	5.54E-01	5.42E-01
1112	2.04E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.04E-01	2.04E-01	2.03E-01	2.01E-01
1570	8.59E-02	8.66E-02	8.71E-02	8.75E-02	8.78E-02	8.81E-02	8.82E-02	8.83E-02	8.84E-02	8.85E-02
14010	3.09E-02	3.60E-02	4.13E-02	4.67E-02	5.21E-02	5.74E-02	6.30E-02	6.84E-02	7.38E-02	8.00E-02
32246	1.05E-04	1.54E-04	2.16E-04	2.93E-04	3.85E-04	4.94E-04	6.21E-04	7.64E-04	9.24E-04	1.40E-03
115303	3.38E-11	1.20E-10	4.23E-10	1.23E-09	3.25E-09	7.84E-09	1.75E-08	3.65E-08	7.18E-08	3.14E-07
144023	2.09E-14	1.13E-13	5.07E-13	1.94E-12	6.67E-12	2.03E-11	5.59E-11	1.42E-10	3.33E-10	1.01E-08
149413	8.93E-14	5.13E-13	2.44E-12	9.92E-12	3.32E-11	1.12E-10	3.21E-10	8.42E-10	2.04E-09	1.41E-08
176739	5.51E-17	4.35E-16	2.74E-15	1.44E-14	6.55E-14	2.57E-13	8.94E-13	2.80E-12	8.01E-12	7.92E-11
206368	3.13E-19	3.50E-18	3.04E-17	2.12E-16	1.23E-15	6.07E-15	2.61E-14	9.91E-14	3.30E-13	4.93E-12
249377	7.19E-23	1.32E-21	1.70E-20	1.85E-19	1.94E-18	1.05E-17	4.09E-17	3.04E-16	1.34E-15	3.37E-14
253000	4.58E-24	9.44E-23	1.56E-21	1.87E-20	1.76E-19	1.35E-18	8.66E-18	4.76E-17	2.28E-16	6.98E-15
180000	6.55E-17	5.73E-16	4.09E-15	2.40E-14	1.19E-13	5.09E-13	1.92E-12	6.48E-12	1.98E-11	2.27E-10
197480	1.71E-18	1.72E-17	1.34E-16	8.73E-16	4.69E-15	2.16E-14	8.72E-14	3.13E-13	1.01E-12	1.11E-11
226800	1.04E-20	1.48E-19	1.59E-18	1.54E-17	9.28E-17	5.37E-16	2.67E-15	1.16E-14	4.47E-14	8.51E-13
249800	2.39E-24	5.57E-23	9.31E-22	1.17E-20	1.16E-19	9.33E-19	6.24E-18	3.57E-17	1.77E-16	9.03E-15
244000	1.34E-25	3.74E-24	7.33E-23	1.07E-21	1.20E-20	1.09E-19	8.11E-19	5.12E-18	2.79E-17	1.12E-15
214000	1.54E-19	1.90E-18	1.79E-17	1.34E-16	8.31E-16	4.35E-15	1.90E-14	7.09E-14	2.82E-13	4.54E-12
208000	1.11E-19	1.26E-18	1.11E-17	7.90E-17	4.64E-16	2.32E-15	1.01E-14	3.08E-14	1.34E-13	1.94E-12
241500	2.77E-22	4.69E-21	5.89E-20	5.73E-19	4.49E-18	2.91E-17	1.61E-16	7.68E-16	3.24E-15	7.47E-14
232000	8.78E-26	2.39E-24	4.59E-23	6.54E-22	7.24E-21	6.44E-20	4.75E-19	2.94E-18	1.59E-17	6.23E-16
246000	4.16E-27	1.37E-25	3.11E-24	5.16E-23	3.56E-22	6.42E-21	5.45E-20	3.77E-19	2.23E-18	1.08E-16
										1.32E-14
										2.71E-15
										4.16E-14

TABLE 58 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF  $\text{Mg}^{++}$ 

LEVEL ( $\text{cm}^{-1}$ )	TEMPERATURE (DEG K)											
	14000	15000	16000	17000	18000	19000	20000	24000	28000	32000	36000	40000
0	5.13E-01	5.03E-01	4.97E-01	4.90E-01	4.84E-01	4.78E-01	4.72E-01	4.53E-01	4.30E-01	4.23E-01	4.08E-01	3.92E-01
1112	2.73E-01	2.72E-01	2.70E-01	2.68E-01	2.66E-01	2.64E-01	2.62E-01	2.54E-01	2.40E-01	2.41E-01	2.34E-01	2.26E-01
1370	6.73E-02	6.69E-02	6.64E-02	6.59E-02	6.54E-02	6.49E-02	6.44E-02	6.29E-02	6.07E-02	7.80E-02	7.07E-02	7.42E-02
14010	1.22E-01	1.32E-01	1.41E-01	1.50E-01	1.58E-01	1.65E-01	1.72E-01	1.96E-01	2.13E-01	2.25E-01	2.33E-01	2.37E-01
33266	3.36E-03	4.15E-03	5.00E-03	5.87E-03	6.78E-03	7.70E-03	8.63E-03	1.23E-02	1.58E-02	1.90E-02	2.16E-02	2.37E-02
114303	7.31E-06	1.57E-05	3.08E-05	5.55E-05	9.38E-05	1.50E-04	2.28E-04	8.62E-04	2.23E-03	4.44E-03	7.63E-03	1.16E-02
144023	1.15E-07	3.03E-07	7.08E-07	1.50E-06	2.91E-06	5.26E-06	8.97E-06	4.84E-05	1.60E-04	3.91E-04	7.79E-04	1.32E-03
149413	8.80E-07	2.41E-06	5.82E-06	1.26E-05	2.52E-05	4.66E-05	8.12E-05	4.67E-04	1.62E-03	4.09E-03	8.32E-03	1.65E-02
176739	1.04E-08	3.51E-08	9.87E-08	2.50E-07	5.67E-07	1.18E-06	2.27E-06	1.87E-05	7.96E-05	2.40E-04	5.92E-04	1.07E-03
204348	1.52E-04	6.13E-04	2.08E-03	6.12E-03	1.59E-02	3.75E-02	8.09E-02	9.22E-04	5.21E-03	1.90E-04	5.13E-04	1.13E-03
248377	3.37E-11	1.82E-10	7.94E-10	2.91E-09	9.24E-09	2.59E-08	6.37E-08	1.24E-06	1.00E-05	4.78E-05	1.60E-04	4.14E-04
243000	1.05E-11	6.26E-11	2.98E-10	1.18E-09	4.02E-09	1.20E-08	3.21E-08	7.22E-07	6.62E-06	3.47E-05	1.25E-04	3.42E-04
180000	4.17E-08	1.49E-07	4.53E-07	1.21E-06	2.88E-06	6.28E-06	1.26E-05	1.16E-04	5.58E-04	1.80E-03	4.46E-03	9.08E-03
197480	3.11E-09	1.20E-08	3.86E-08	1.08E-07	2.70E-07	6.12E-07	1.28E-06	1.31E-05	6.84E-05	2.34E-04	6.18E-04	1.29E-03
228800	4.64E-10	2.16E-09	8.29E-09	2.71E-08	7.78E-08	1.99E-07	4.65E-07	6.77E-06	4.54E-05	1.89E-04	5.47E-04	1.35E-03
268600	1.03E-11	6.43E-11	2.14E-10	1.29E-09	4.52E-09	1.38E-08	3.78E-08	9.10E-07	9.78E-06	4.77E-05	1.76E-04	4.94E-04
294000	3.03E-12	2.09E-11	1.15E-10	5.03E-10	1.88E-09	6.12E-09	1.77E-08	5.13E-07	5.63E-06	3.37E-05	1.35E-04	4.02E-04
214000	1.73E-09	7.38E-09	2.62E-08	8.02E-08	2.14E-07	5.26E-07	1.17E-06	1.44E-05	8.80E-05	3.34E-04	9.44E-04	2.14E-03
208000	6.41E-10	2.62E-09	8.99E-09	2.64E-08	6.96E-08	1.64E-07	3.60E-07	4.18E-06	2.40E-05	8.81E-05	2.48E-04	5.30E-04
241500	6.15E-11	3.16E-10	1.33E-09	4.69E-09	1.44E-08	3.93E-08	9.70E-08	1.68E-06	1.29E-05	5.86E-05	1.89E-04	4.77E-04
287000	1.60E-12	1.08E-11	5.79E-11	2.54E-10	9.43E-10	3.05E-09	8.77E-09	2.47E-07	2.67E-06	1.58E-05	6.25E-05	1.95E-04
298000	4.31E-13	3.27E-12	1.92E-11	9.17E-11	3.68E-10	1.27E-09	3.88E-09	1.33E-07	1.64E-06	1.08E-05	4.61E-05	1.44E-04

TABLE 58 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR<sup>++</sup>

LEVEL	TEMPERATURE (DEG K)									
	10000	20000	40000	60000	80000	100000	200000	400000	600000	1000000
100-11	0	0	0	0	0	0	0	0	0	0
1112	3.74E-01	3.54E-01	2.82E-01	1.74E-01	1.09E-01	2.93E-02	1.34E-02	1.01E-02	8.11E-03	0.
1370	2.14E-01	2.09E-01	1.65E-01	1.02E-01	6.43E-02	1.75E-02	7.98E-03	6.07E-03	4.84E-03	0.
14010	7.11E-02	6.79E-02	5.43E-02	3.38E-02	2.13E-02	5.80E-03	2.64E-03	2.02E-03	1.62E-03	0.
33246	2.37E-01	2.32E-01	2.02E-01	1.35E-01	8.90E-02	2.89E-02	1.27E-02	9.81E-03	7.95E-03	0.
114303	2.52E-02	2.61E-02	2.54E-02	1.91E-02	1.35E-02	6.62E-03	2.37E-03	1.87E-03	1.55E-03	0.
154023	1.60E-02	2.07E-02	3.28E-02	4.01E-02	3.78E-02	2.32E-02	1.59E-02	1.39E-02	1.24E-02	0.
159413	2.02E-03	2.83E-03	5.34E-03	7.82E-03	8.22E-03	6.25E-03	4.77E-03	4.31E-03	3.94E-03	0.
174739	2.24E-02	3.21E-02	6.27E-02	9.47E-02	1.01E-01	8.01E-02	6.24E-02	5.67E-02	5.23E-02	0.
204348	1.84E-03	2.83E-03	6.52E-03	1.14E-02	1.31E-02	1.32E-02	1.13E-02	1.04E-02	1.01E-02	0.
248377	2.11E-03	3.49E-03	9.41E-03	2.04E-02	2.68E-02	3.19E-02	3.09E-02	2.97E-02	2.89E-02	0.
283000	8.89E-04	1.55E-03	5.85E-03	1.60E-02	2.64E-02	3.93E-02	4.37E-02	4.47E-02	4.54E-02	0.
188000	7.72E-04	1.99E-03	5.70E-03	1.72E-02	2.71E-02	4.95E-02	5.81E-02	6.09E-02	6.27E-02	0.
197480	1.60E-02	2.52E-02	6.22E-02	1.18E-01	1.48E-01	1.52E-01	1.34E-01	1.29E-01	1.24E-01	0.
226400	2.35E-03	3.80E-03	9.91E-03	1.99E-02	2.94E-02	2.83E-02	2.63E-02	2.53E-02	2.44E-02	0.
268800	2.70E-03	4.74E-03	1.47E-02	3.53E-02	5.00E-02	6.89E-02	7.09E-02	7.07E-02	7.02E-02	0.
284000	1.14E-03	2.24E-03	8.94E-03	2.77E-02	4.55E-02	8.48E-02	1.02E-01	1.07E-01	1.10E-01	0.
214000	9.71E-04	1.99E-03	8.71E-03	2.95E-02	5.12E-02	1.04E-01	1.39E-01	1.44E-01	1.51E-01	0.
208000	4.10E-03	6.95E-03	2.00E-02	4.45E-02	6.01E-02	7.55E-02	7.42E-02	7.29E-02	7.16E-02	0.
241500	9.99E-04	1.64E-03	4.62E-03	9.90E-03	1.31E-02	1.58E-02	1.52E-02	1.48E-02	1.44E-02	0.
282000	1.00E-03	1.83E-03	6.21E-03	1.63E-02	2.43E-02	3.72E-02	4.04E-02	4.09E-02	4.13E-02	0.
298000	4.44E-04	9.05E-04	3.92E-03	1.31E-02	2.26E-02	4.43E-02	5.81E-02	6.19E-02	6.49E-02	0.
368E-04	3.68E-04	7.84E-04	3.74E-03	1.37E-02	2.51E-02	5.78E-02	7.68E-02	8.34E-02	8.88E-02	0.

TABLE 59. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C 3+

STATE	LEVEL	STAT.	TEMPERATURE (DEG K)											
			(CM-1)	(EV)	WT.	3200	3600	4000	4400	4800	5200	5600	6000	6400
1s 2s 2p	0	2	0	0.	2	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
	64556	6	8.0037	0.	6	7.44E-13	1.87E-11	2.47E-10	2.04E-09	1.13E-08	5.24E-08	1.68E-07	5.48E-07	1.49E-06
	302849	2	37.5475	2	0.	0.	0.	0.	0.	0.	4.04E-37	1.61E-34	2.89E-32	2.70E-30
	320071	6	39.6827	6	0.	0.	0.	0.	0.	0.	0.	5.79E-36	1.39E-33	1.69E-31
	324886	10	40.2797	10	0.	0.	0.	0.	0.	0.	0.	2.80E-34	7.32E-34	9.53E-32
4s	401348	2	49.7595	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	408320	6	50.6239	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	410339	10	50.8742	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	410433	14	50.8859	14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	220000*	2	27.2758	2	0.	6.52E-39	4.29E-35	5.72E-32	2.29E-29	3.64E-27	2.63E-25	1.23E-23	5.14E-21	4.61E-19
1s 2s 2p 3s 3p	300000*	18	37.1943	18	0.	0.	0.	0.	0.	0.	8.03E-34	3.02E-33	1.71E-31	1.54E-29
	300000*	6	37.1943	6	0.	0.	0.	0.	0.	0.	2.68E-34	1.01E-33	0.	0.
	380000*	30	47.1128	30	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.19E-36

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
MONSTARMED ENERGY LEVELS FROM MOORE (1949) AND BOCKASTEN (1956)

TABLE 59 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C 3+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	14000	15000	16000	17000	18000	19000	20000	24000	28000	36000
0	9.96E-01	9.94E-01	9.91E-01	9.87E-01	9.83E-01	9.78E-01	9.72E-01	9.61E-01	9.59E-01	8.15E-01
64556	3.93E-03	6.10E-03	8.94E-03	1.26E-02	1.89E-02	2.21E-02	2.80E-02	5.89E-02	9.81E-02	1.89E-01
302849	3.03E-14	2.41E-13	1.47E-12	7.29E-12	3.02E-11	1.07E-10	3.36E-10	1.32E-08	1.37E-07	1.03E-06
320071	1.55E-14	1.38E-13	9.40E-13	5.09E-12	2.28E-11	8.73E-11	2.92E-10	1.31E-08	1.43E-07	8.69E-06
324886	1.57E-14	1.49E-13	1.02E-12	5.65E-12	2.59E-11	1.01E-10	3.44E-10	1.54E-08	2.53E-07	1.94E-06
401348	1.22E-18	1.90E-17	2.10E-16	1.75E-15	1.15E-14	6.10E-14	2.81E-13	3.34E-11	9.97E-10	1.25E-08
403320	1.78E-18	2.92E-17	3.34E-16	2.91E-15	1.87E-14	1.09E-13	5.10E-13	6.60E-11	2.09E-09	2.74E-08
410339	2.41E-18	4.01E-17	4.64E-16	4.06E-15	2.80E-14	1.56E-13	7.35E-13	9.75E-11	3.14E-09	4.17E-08
410433	3.35E-18	5.56E-17	6.49E-16	5.57E-15	3.89E-14	2.17E-13	1.02E-12	1.34E-10	4.37E-09	5.81E-08
220000	1.51E-10	6.80E-10	2.54E-09	8.09E-09	2.27E-08	5.69E-08	1.30E-07	1.74E-06	1.11E-05	4.34E-05
300000	3.65E-13	2.85E-12	1.71E-11	8.35E-11	3.41E-10	1.20E-09	3.71E-09	1.31E-07	1.64E-06	1.07E-05
300000	1.22E-13	9.49E-13	5.72E-12	2.70E-11	1.14E-10	3.99E-10	1.24E-09	4.37E-08	5.44E-07	3.57E-06
380000	1.64E-16	2.21E-15	2.15E-14	1.60E-13	9.49E-13	4.67E-12	1.96E-11	1.80E-09	4.48E-08	4.89E-07
380000	1.64E-16	2.21E-15	2.15E-14	1.60E-13	9.49E-13	4.67E-12	1.96E-11	1.80E-09	4.48E-08	4.89E-07
380000	1.64E-16	2.21E-15	2.15E-14	1.60E-13	9.49E-13	4.67E-12	1.96E-11	1.80E-09	4.48E-08	4.89E-07

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	44000	48000	60000	80000	100000	200000	400000	600000	1000000	8
0	7.33E-01	6.96E-01	6.03E-01	4.84E-01	3.87E-01	1.39E-01	5.48E-02	3.82E-02	2.42E-02	0.
64556	2.64E-01	3.02E-01	3.83E-01	4.54E-01	4.59E-01	2.62E-01	1.30E-01	9.81E-02	7.70E-02	0.
302849	3.66E-05	7.95E-05	4.23E-04	2.08E-03	4.96E-03	1.57E-02	1.84E-02	1.85E-02	1.82E-02	0.
320071	6.91E-05	1.42E-04	8.39E-04	4.59E-03	1.16E-02	4.17E-02	5.20E-02	5.31E-02	5.33E-02	0.
324886	8.91E-05	2.05E-04	1.23E-03	7.01E-03	1.81E-02	6.72E-02	8.52E-02	8.74E-02	8.83E-02	0.
401348	1.44E-06	4.15E-06	3.99E-05	3.55E-04	1.20E-03	7.75E-03	1.29E-02	1.44E-02	1.58E-02	0.
403320	3.49E-06	1.01E-05	1.01E-04	9.28E-04	3.24E-03	2.21E-02	2.79E-02	4.30E-02	4.70E-02	0.
410339	5.45E-06	1.58E-05	1.61E-04	1.51E-03	5.28E-03	3.43E-02	2.45E-02	7.13E-02	7.81E-02	0.
410433	7.61E-06	2.21E-05	2.24E-04	2.11E-03	7.38E-03	5.08E-02	3.77E-02	9.94E-02	1.09E-01	0.
220000	5.50E-04	9.52E-04	3.08E-03	9.25E-03	1.83E-02	2.84E-02	2.48E-02	2.53E-02	2.05E-02	0.
300000	3.62E-04	7.79E-04	4.08E-03	1.97E-02	4.65E-02	1.45E-01	1.48E-01	1.67E-01	1.65E-01	0.
300000	1.21E-04	2.60E-04	1.34E-03	4.58E-03	1.55E-02	4.82E-02	5.59E-02	5.58E-02	5.49E-02	0.
380000	4.41E-05	1.18E-04	9.97E-04	7.81E-03	2.45E-02	1.34E-01	2.10E-01	2.30E-01	2.45E-01	0.



TABLE 60 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N 3+

[illegible]

ESTIMATED \*\*INCLUDES ESTIMATED SUALEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949)

TABLE 60 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N 3+

LEVEL (CM-1)	TEMPERATURE (DEG K)										34000	40000
	14000	15000	16000	17000	18000	19000	20000	24000	28000	32000		
0	9.91E-01	9.86E-01	9.79E-01	9.71E-01	9.60E-01	9.48E-01	9.33E-01	8.61E-01	7.74E-01	6.90E-01	6.10E-01	5.41E-01
67273	8.87E-02	1.40E-02	2.08E-02	2.91E-02	3.99E-02	5.23E-02	6.64E-02	1.37E-01	2.20E-01	3.01E-01	3.73E-01	4.33E-01
130695	4.36E-05	1.04E-05	2.31E-05	4.57E-05	8.36E-05	1.43E-04	2.31E-04	1.02E-03	2.80E-03	5.80E-03	9.87E-03	1.47E-02
175598	1.30E-07	4.30E-07	1.22E-06	3.07E-06	6.93E-06	1.43E-05	2.74E-05	2.08E-04	8.42E-04	2.31E-03	4.92E-03	8.79E-03
188885	1.84E-08	6.67E-08	2.06E-07	5.54E-07	1.33E-06	2.91E-06	5.86E-06	5.20E-05	2.34E-04	7.07E-04	1.61E-03	3.03E-03
235370	3.10E-11	1.55E-10	6.29E-10	2.17E-09	6.48E-09	1.72E-08	4.13E-08	4.41E-07	4.34E-06	1.75E-05	5.01E-05	1.14E-04
380119	4.29E-17	5.77E-16	5.60E-15	4.16E-14	2.65E-13	1.20E-12	4.87E-12	4.37E-10	1.02E-08	1.04E-07	6.18E-07	2.68E-06
405375	9.41E-18	1.51E-16	1.70E-15	1.44E-14	9.45E-14	5.22E-13	2.59E-12	2.88E-10	8.28E-09	9.96E-08	6.48E-07	2.79E-06
422270	2.82E-18	5.06E-17	6.32E-16	8.85E-15	4.21E-14	2.68E-13	1.60E-12	1.75E-10	7.65E-09	7.84E-08	5.72E-07	2.74E-06
492000	4.35E-22	1.65E-20	2.39E-19	3.20E-18	3.20E-17	2.50E-16	1.95E-15	5.34E-13	3.25E-11	6.82E-10	7.04E-09	4.46E-08
504474	3.62E-22	1.14E-20	2.34E-19	3.34E-18	3.54E-17	2.92E-16	1.94E-15	7.59E-13	5.14E-11	1.17E-09	1.28E-08	8.54E-08
512190	2.33E-22	9.09E-21	1.95E-19	2.90E-18	3.18E-17	2.71E-16	1.86E-15	7.94E-13	5.76E-11	1.37E-09	1.57E-08	1.00E-07
517948	2.12E-22	7.32E-21	1.62E-19	2.45E-18	2.81E-17	2.45E-16	1.72E-15	7.89E-13	6.00E-11	1.49E-09	1.73E-08	1.23E-07
567295	1.65E-20	4.04E-19	6.61E-18	7.66E-17	6.91E-16	4.87E-15	2.82E-14	7.05E-12	3.47E-10	6.21E-09	5.67E-08	3.24E-07
469820	4.91E-21	1.40E-19	2.62E-18	3.41E-17	3.43E-16	2.66E-15	1.67E-14	5.48E-12	5.28E-10	6.77E-09	6.92E-08	4.34E-07
504615	1.79E-21	5.64E-20	1.15E-18	1.65E-17	1.75E-16	1.44E-15	9.61E-15	2.74E-12	2.55E-10	5.80E-09	6.38E-08	4.25E-07
576000	2.31E-25	1.20E-23	3.76E-22	7.04E-21	1.16E-19	1.30E-18	1.13E-17	1.04E-14	1.30E-12	4.48E-11	7.34E-10	6.52E-09
587700	2.10E-25	1.17E-23	3.94E-22	8.74E-21	1.37E-19	1.60E-18	1.44E-17	1.59E-14	2.14E-12	8.39E-11	1.38E-09	1.21E-08
593000	2.03E-25	1.17E-23	4.08E-22	9.30E-21	1.50E-19	1.79E-18	1.64E-17	1.88E-14	2.72E-12	1.09E-10	1.87E-09	1.77E-08
598020	1.70E-25	1.02E-23	3.64E-22	8.53E-21	1.40E-19	1.72E-18	1.63E-17	1.95E-14	2.94E-12	1.22E-10	2.14E-09	2.07E-08

LEVEL (CM-1)	TEMPERATURE (DEG K)										0	0	0
	44000	48000	60000	80000	100000	200000	400000	600000	1000000	1000000			
0	4.81E-01	4.31E-01	3.21E-01	2.18E-01	1.61E-01	4.77E-02	1.30E-02	7.58E-03	4.80E-03	0.	0.	0.	0.
67273	4.80E-01	5.16E-01	5.75E-01	5.86E-01	5.49E-01	2.64E-01	9.18E-02	5.81E-02	3.92E-02	0.	0.	0.	0.
130695	2.01E-02	2.57E-02	4.19E-02	6.24E-02	7.34E-02	5.59E-02	2.44E-02	1.64E-02	1.19E-02	0.	0.	0.	0.
175598	1.39E-02	2.01E-02	4.28E-02	8.35E-02	1.16E-01	1.21E-01	6.22E-02	4.48E-02	3.35E-02	0.	0.	0.	0.
188885	5.00E-03	7.48E-03	1.75E-02	3.65E-02	5.30E-02	6.13E-02	3.29E-02	2.41E-02	1.83E-02	0.	0.	0.	0.
235370	2.19E-04	3.72E-04	1.13E-03	3.17E-03	5.43E-03	8.77E-03	5.57E-03	3.31E-03	3.42E-03	0.	0.	0.	0.
380119	7.69E-06	1.94E-05	1.41E-04	9.37E-04	2.71E-03	1.24E-02	1.32E-02	1.22E-02	1.11E-02	0.	0.	0.	0.
405375	1.00E-05	2.71E-05	2.30E-04	1.78E-03	5.63E-03	3.09E-02	3.63E-02	3.44E-02	3.21E-02	0.	0.	0.	0.
422270	9.49E-06	2.74E-05	2.57E-04	2.20E-03	7.39E-03	4.57E-02	5.69E-02	5.51E-02	5.23E-02	0.	0.	0.	0.
492000	1.98E-07	6.78E-07	9.65E-06	1.25E-04	5.42E-04	5.54E-03	8.86E-03	9.32E-03	9.45E-03	0.	0.	0.	0.
504474	3.95E-07	1.40E-06	2.15E-05	3.00E-04	1.34E-03	1.52E-02	2.54E-02	2.71E-02	2.79E-02	0.	0.	0.	0.
512190	5.12E-07	1.85E-06	2.87E-05	4.38E-04	2.03E-03	2.39E-02	4.12E-02	4.44E-02	4.58E-02	0.	0.	0.	0.
517948	5.94E-07	2.06E-06	3.62E-05	5.30E-04	2.61E-03	3.22E-02	5.85E-02	6.18E-02	6.38E-02	0.	0.	0.	0.
467295	1.33E-06	4.27E-06	5.23E-05	5.85E-04	2.52E-03	1.98E-02	2.90E-02	2.97E-02	2.94E-02	0.	0.	0.	0.
489800	1.92E-06	6.52E-06	9.15E-05	1.17E-03	5.03E-03	5.06E-02	8.03E-02	8.43E-02	8.54E-02	0.	0.	0.	0.
504615	1.97E-06	6.97E-06	1.07E-04	1.50E-03	6.78E-03	7.58E-02	1.27E-01	1.34E-01	1.39E-01	0.	0.	0.	0.
576000	3.81E-08	1.64E-07	3.86E-06	8.30E-05	4.98E-04	1.94E-02	2.29E-02	2.29E-02	2.51E-02	0.	0.	0.	0.
587700	7.80E-08	3.44E-07	8.75E-06	2.03E-04	2.50E-02	2.50E-02	6.65E-02	6.65E-02	7.41E-02	0.	0.	0.	0.
593000	1.09E-07	4.93E-07	1.28E-05	3.04E-04	1.90E-03	4.02E-02	9.24E-02	1.10E-01	1.23E-01	0.	0.	0.	0.
598020	1.30E-07	5.94E-07	1.59E-05	3.91E-04	2.47E-03	5.42E-02	1.27E-01	1.52E-01	1.70E-01	0.	0.	0.	0.

TABLE 61. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O 3+

STATE	LEVEL (CM-1)	STAT. WT.	TEMPERATURE (DEG K)									
			3200	3600	4000	4400	4800	5200	5600	6000	6400	
2p 3p 3d 4p 4d	0	2	3.73E-01	3.68E-01	3.65E-01	3.62E-01	3.60E-01	3.58E-01	3.56E-01	3.54E-01	3.53E-01	
	386	4	6.27E-01	6.32E-01	6.35E-01	6.38E-01	6.40E-01	6.42E-01	6.44E-01	6.46E-01	6.47E-01	
	71379	12	2.58E-14	9.02E-13	1.55E-11	1.59E-10	1.10E-09	5.48E-09	2.32E-08	7.83E-08	2.27E-07	
	126942	10	3.04E-25	1.71E-22	2.70E-20	1.70E-18	5.37E-17	9.94E-16	1.22E-14	1.07E-13	1.12E-13	
	164367	2	2.49E-33	1.09E-29	7.69E-27	1.65E-24	1.44E-22	6.34E-21	1.62E-19	2.70E-18	3.16E-17	
2p 3p 3d 4p 4d	180444	6	5.95E-36	4.88E-32	6.61E-29	2.41E-26	3.29E-24	2.11E-22	7.44E-21	1.64E-19	2.44E-18	
	231275	4	0.	0.	5.43E-37	1.04E-33	5.67E-31	1.18E-28	1.11E-26	5.82E-25	1.94E-23	
	255168	10	0.	0.	0.	1.05E-36	1.09E-33	3.89E-31	6.00E-29	4.72E-27	2.16E-25	
	289021	6	0.	0.	0.	0.	2.58E-38	2.00E-35	8.45E-31	6.40E-29	6.40E-29	
	357615	2	0.	0.	0.	0.	0.	0.	0.	2.02E-38	4.29E-36	
2p 3p 3d 4p 4d	390219	6	0.	0.	0.	0.	0.	0.	0.	0.	8.44E-39	
	419544	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	485823	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	504000*	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	511000**	24	0.	0.	0.	0.	0.	0.	0.	0.	0.	
2p 3p 3d 4p 4d	443945	18	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	474555	54	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	501721	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	590400**	268	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	555874	54	0.	0.	0.	0.	0.	0.	0.	0.	0.	
2p 3p 3d 4p 4d	646000**	96	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	617000**	142	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	721900*	288	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	636000**	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	740000*	160	0.	0.	0.	0.	0.	0.	0.	0.	0.	
2p 3p 3d 4p 4d	693000*	18	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	796000*	32	0.	0.	0.	0.	0.	0.	0.	0.	0.	

\*ESTIMATED \*\*INCLUDES ESTIMATED SUM LEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949)

TABLE 61 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF D 3+

LEVEL	TEMPERATURE (DEG K)											
	6000	7200	7600	8000	8400	8800	9200	9600	10000	11000	12000	13000
0	3.52E-01	3.51E-01	3.50E-01	3.49E-01	3.48E-01	3.48E-01	3.47E-01	3.46E-01	3.45E-01	3.44E-01	3.44E-01	3.43E-01
346	6.48E-01	6.49E-01	6.50E-01	6.51E-01	6.52E-01	6.53E-01	6.54E-01	6.55E-01	6.56E-01	6.57E-01	6.58E-01	6.59E-01
71379	3.83E-07	1.34E-06	2.84E-06	5.31E-06	1.02E-05	1.78E-05	2.95E-05	4.86E-05	7.95E-05	1.28E-04	2.04E-04	3.12E-04
126922	3.81E-12	1.84E-11	6.39E-11	2.12E-10	6.28E-10	1.68E-09	4.14E-09	9.46E-09	2.02E-08	4.06E-07	4.22E-07	1.52E-06
164367	2.77E-16	1.91E-15	1.07E-14	5.06E-14	2.08E-13	7.41E-13	2.38E-12	6.93E-12	1.83E-11	1.59E-10	9.44E-10	4.31E-09
180644	2.65E-17	2.21E-16	1.47E-15	8.13E-15	3.81E-14	1.55E-13	5.40E-13	1.81E-12	5.35E-12	1.64E-11	4.04E-10	2.13E-09
231275	3.94E-22	5.95E-21	6.76E-20	6.02E-19	4.33E-18	2.63E-17	1.36E-16	6.12E-16	2.53E-15	5.02E-14	6.23E-13	5.24E-12
255168	6.27E-24	1.24E-22	1.83E-21	2.05E-20	1.82E-19	1.32E-18	8.10E-18	4.26E-17	1.97E-16	5.31E-15	8.87E-14	9.31E-13
289021	2.92E-27	8.69E-26	1.81E-24	2.79E-23	3.31E-22	3.13E-21	2.44E-20	1.60E-19	9.04E-19	3.93E-17	9.19E-16	1.32E-14
357615	4.84E-34	3.23E-32	1.38E-30	4.08E-29	8.70E-28	1.41E-26	1.78E-25	1.83E-24	1.54E-23	1.67E-21	8.21E-20	2.22E-18
390219	1.46E-36	1.43E-34	8.67E-33	3.47E-31	9.80E-30	2.04E-28	3.24E-27	4.14E-26	4.29E-25	7.03E-23	4.94E-21	1.80E-19
419544	0.	6.81E-37	5.61E-35	2.97E-33	1.08E-31	2.82E-30	5.25E-29	8.32E-28	1.03E-26	2.53E-24	2.45E-22	1.17E-20
485823	0.	0.	0.	3.95E-39	2.53E-37	1.11E-35	3.49E-34	8.27E-33	1.52E-31	8.71E-29	1.73E-26	1.52E-24
504000	0.	0.	0.	0.	3.37E-34	1.70E-34	6.11E-35	1.63E-35	3.33E-32	2.45E-29	5.84E-27	6.12E-25
511000	0.	0.	0.	0.	4.06E-38	2.17E-34	8.18E-35	2.28E-33	4.87E-32	3.86E-29	1.02E-26	1.13E-24
643545	0.	0.	1.07E-36	7.13E-35	3.17E-33	1.00E-31	2.34E-30	4.20E-29	5.99E-28	1.90E-25	2.48E-23	1.48E-21
674535	0.	0.	0.	8.09E-37	4.70E-35	1.89E-33	5.50E-32	1.21E-30	2.08E-29	1.03E-26	1.81E-24	1.43E-22
501721	0.	0.	0.	0.	7.45E-37	3.70E-35	1.31E-33	3.44E-32	6.94E-31	1.96E-28	1.14E-25	1.18E-23
559874	0.	0.	0.	0.	0.	0.	0.	0.	6.39E-36	1.44E-32	8.94E-30	2.07E-27
664000	0.	0.	0.	0.	0.	0.	8.82E-38	3.38E-34	9.84E-35	1.44E-31	6.51E-29	1.14E-26
617000	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.43E-37	3.45E-34	1.40E-31
721900	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.49E-34	2.07E-31	4.12E-29
636000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.27E-36	9.87E-34
740000	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.19E-35	1.18E-32	4.15E-30
693000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.40E-35
796000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.54E-36	1.51E-33
											0.	0.

TABLE 61 (CONT.) 1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF D 3+

LEVEL	TEMPERATURE (DEG K)									
	14000	15000	16000	17000	18000	19000	20000	24000	28000	32000
10M-11	3.42E-01	3.41E-01	3.40E-01	3.39E-01	3.38E-01	3.37E-01	3.35E-01	3.29E-01	3.20E-01	3.10E-01
G	6.57E-01	6.57E-01	6.57E-01	6.56E-01	6.55E-01	6.54E-01	6.53E-01	6.49E-01	6.40E-01	6.29E-01
386	1.34E-03	1.34E-03	1.34E-03	1.33E-03	1.33E-03	1.32E-03	1.31E-03	1.29E-03	1.27E-03	1.25E-03
71379	3.69E-04	3.69E-04	3.69E-04	3.68E-04	3.67E-04	3.66E-04	3.65E-04	3.63E-04	3.61E-04	3.59E-04
126942	1.58E-08	1.58E-08	1.58E-08	1.57E-08	1.56E-08	1.55E-08	1.54E-08	1.52E-08	1.50E-08	1.48E-08
164367	8.88E-09	8.88E-09	8.88E-09	8.87E-09	8.86E-09	8.85E-09	8.84E-09	8.82E-09	8.80E-09	8.78E-09
180444	3.25E-11	3.25E-11	3.25E-11	3.24E-11	3.23E-11	3.22E-11	3.21E-11	3.19E-11	3.17E-11	3.15E-11
231275	6.98E-12	6.98E-12	6.98E-12	6.97E-12	6.96E-12	6.95E-12	6.94E-12	6.92E-12	6.90E-12	6.88E-12
255168	1.29E-13	1.29E-13	1.29E-13	1.28E-13	1.27E-13	1.26E-13	1.25E-13	1.23E-13	1.21E-13	1.19E-13
289021	3.74E-17	3.74E-17	3.74E-17	3.73E-17	3.72E-17	3.71E-17	3.70E-17	3.68E-17	3.66E-17	3.64E-17
337615	5.88E-17	5.88E-17	5.88E-17	5.87E-17	5.86E-17	5.85E-17	5.84E-17	5.82E-17	5.80E-17	5.78E-17
390219	3.22E-19	3.22E-19	3.22E-19	3.21E-19	3.20E-19	3.19E-19	3.18E-19	3.16E-19	3.14E-19	3.12E-19
419344	7.08E-23	7.08E-23	7.08E-23	7.07E-23	7.06E-23	7.05E-23	7.04E-23	7.02E-23	7.00E-23	6.98E-23
485823	3.28E-23	3.28E-23	3.28E-23	3.27E-23	3.26E-23	3.25E-23	3.24E-23	3.22E-23	3.20E-23	3.18E-23
504000	6.39E-23	6.39E-23	6.39E-23	6.38E-23	6.37E-23	6.36E-23	6.35E-23	6.33E-23	6.31E-23	6.29E-23
511000	4.91E-20	4.91E-20	4.91E-20	4.90E-20	4.89E-20	4.88E-20	4.87E-20	4.85E-20	4.83E-20	4.81E-20
443345	6.09E-21	6.09E-21	6.09E-21	6.08E-21	6.07E-21	6.06E-21	6.05E-21	6.03E-21	6.01E-21	5.99E-21
474555	6.22E-22	6.22E-22	6.22E-22	6.21E-22	6.20E-22	6.19E-22	6.18E-22	6.16E-22	6.14E-22	6.12E-22
501721	2.19E-25	2.19E-25	2.19E-25	2.18E-25	2.17E-25	2.16E-25	2.15E-25	2.13E-25	2.11E-25	2.09E-25
590400	9.47E-25	9.47E-25	9.47E-25	9.46E-25	9.45E-25	9.44E-25	9.43E-25	9.41E-25	9.39E-25	9.37E-25
559874	1.09E-29	1.09E-29	1.09E-29	1.08E-29	1.07E-29	1.06E-29	1.05E-29	1.03E-29	1.01E-29	9.99E-29
646000	8.01E-27	8.01E-27	8.01E-27	8.00E-27	7.99E-27	7.98E-27	7.97E-27	7.95E-27	7.93E-27	7.91E-27
617000	2.94E-31	2.94E-31	2.94E-31	2.93E-31	2.92E-31	2.91E-31	2.90E-31	2.88E-31	2.86E-31	2.84E-31
721900	6.32E-28	6.32E-28	6.32E-28	6.31E-28	6.30E-28	6.29E-28	6.28E-28	6.26E-28	6.24E-28	6.22E-28
636000	2.56E-32	2.56E-32	2.56E-32	2.55E-32	2.54E-32	2.53E-32	2.52E-32	2.50E-32	2.48E-32	2.46E-32
740000	3.61E-31	3.61E-31	3.61E-31	3.60E-31	3.59E-31	3.58E-31	3.57E-31	3.55E-31	3.53E-31	3.51E-31
693000	1.62E-35	1.62E-35	1.62E-35	1.61E-35	1.60E-35	1.59E-35	1.58E-35	1.56E-35	1.54E-35	1.52E-35
796000	3.70E-33	3.70E-33	3.70E-33	3.69E-33	3.68E-33	3.67E-33	3.66E-33	3.64E-33	3.62E-33	3.60E-33

TABLE 61 (CONT.) 1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O 3+

LEVEL	TEMPERATURE (DEG K)									
	44000	48000	52000	56000	60000	64000	68000	72000	76000	80000
1C4-11	0	0	0	0	0	0	0	0	0	0
0	2.74E-01	2.42E-01	2.28E-01	1.83E-01	1.50E-01	4.92E-02	1.08E-02	5.67E-03	3.27E-03	0.
346	5.41E-01	5.10E-01	4.52E-01	3.44E-01	2.97E-01	9.81E-02	2.17E-02	6.53E-03	0.	0.
71379	1.59E-01	1.85E-01	2.01E-01	3.03E-01	3.21E-01	1.77E-01	5.03E-02	2.87E-02	1.77E-02	0.
124942	2.14E-02	2.91E-02	5.43E-02	9.34E-02	1.20E-01	9.87E-02	3.43E-02	2.09E-02	1.34E-02	0.
164367	1.27E-03	1.90E-03	4.43E-03	9.54E-03	1.41E-02	1.51E-02	6.00E-03	3.83E-03	2.58E-03	0.
180644	2.24E-03	3.50E-03	8.99E-03	2.13E-02	3.34E-02	4.02E-02	1.70E-02	1.10E-02	7.54E-03	0.
231275	2.89E-04	5.11E-04	1.78E-03	5.73E-03	1.07E-02	1.86E-02	9.44E-03	6.52E-03	4.69E-03	0.
235168	3.24E-04	6.24E-04	2.51E-03	9.31E-03	1.90E-02	3.92E-02	2.17E-02	1.54E-02	1.13E-02	0.
289921	6.44E-05	1.34E-04	6.09E-04	3.04E-03	7.01E-03	1.85E-02	1.15E-02	8.51E-03	6.47E-03	0.
357615	2.29E-06	5.79E-06	4.30E-05	2.95E-04	8.71E-04	3.76E-03	3.00E-03	2.41E-03	1.95E-03	0.
390219	2.34E-04	6.53E-04	5.91E-05	4.53E-04	1.64E-03	8.91E-03	7.99E-03	6.68E-03	5.99E-03	0.
419544	1.51E-06	4.52E-06	4.87E-05	8.84E-04	1.79E-03	1.20E-02	1.20E-02	1.04E-02	8.94E-03	0.
485823	3.45E-08	1.24E-07	1.09E-06	2.94E-05	1.38E-04	1.49E-03	1.89E-03	1.77E-03	1.62E-03	0.
504000	5.72E-08	2.14E-07	3.84E-06	6.34E-05	3.18E-04	3.93E-03	5.31E-03	5.08E-03	4.74E-03	0.
511000	1.82E-07	7.00E-07	1.30E-05	2.24E-04	1.15E-03	1.50E-02	2.07E-02	2.00E-02	1.80E-02	0.
643545	1.24E-04	3.94E-04	4.91E-05	5.64E-04	2.28E-03	1.82E-02	1.98E-02	1.74E-02	1.55E-02	0.
474555	1.35E-06	4.40E-06	7.03E-05	9.73E-05	4.37E-04	4.37E-02	5.31E-02	4.91E-02	4.44E-02	0.
501721	9.24E-07	3.97E-06	6.11E-05	9.95E-04	4.93E-03	5.99E-02	8.03E-02	7.47E-02	7.15E-02	0.
559874	1.63E-07	7.77E-07	2.33E-05	6.48E-04	4.41E-03	1.01E-01	1.87E-01	1.98E-01	2.01E-01	0.
559874	8.29E-08	3.64E-07	9.09E-06	2.10E-04	1.28E-03	2.37E-02	3.91E-02	4.00E-02	3.94E-02	0.
56000	4.58E-09	2.60E-08	1.27E-06	5.53E-05	4.95E-04	1.96E-02	4.74E-02	5.51E-02	6.02E-02	0.
617000	3.84E-08	1.97E-07	6.03E-06	2.25E-04	1.69E-03	4.71E-02	9.55E-02	1.09E-01	1.09E-01	0.
721900	2.21E-09	1.51E-08	9.98E-07	6.07E-05	6.64E-04	3.94E-02	1.16E-01	1.45E-01	1.67E-01	0.
634000	1.15E-08	6.19E-08	8.89E-05	7.14E-04	2.28E-02	4.95E-02	5.54E-02	5.54E-02	5.89E-02	0.
740000	6.79E-10	4.87E-09	3.58E-07	2.43E-05	2.84E-04	1.92E-02	6.04E-02	7.70E-02	9.02E-02	0.
893000	3.59E-10	2.24E-09	1.74E-07	6.38E-04	4.29E-05	3.03E-03	8.07E-03	9.69E-03	1.09E-02	0.
796500	2.18E-11	1.82E-10	1.37E-08	1.78E-06	2.54E-05	2.57E-03	9.90E-03	1.35E-02	1.64E-02	0.

TABLE 42. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 3+

STATE	LEVEL	STAT.	TEMPERATURE (DEG K)											
			3200	3400	4000	4400	4800	5200	5600	6000	6400	6800	7200	7600
3s 3p <sup>2</sup> 3s <sup>2</sup>	(CM-1)	WT.												
	0	4	1.06E-00	9.99E-01	9.99E-01	9.99E-01	9.94E-01	9.93E-01	9.89E-01	9.84E-01	9.78E-01	9.73E-01	9.68E-01	9.63E-01
	21167	10	1.84E-04	5.20E-04	1.21E-03	2.44E-03	4.37E-03	7.10E-03	1.07E-02	1.54E-02	2.10E-02	2.76E-02	3.52E-02	4.38E-02
	34975	6	2.22E-07	9.47E-06	5.13E-05	1.61E-04	4.18E-04	9.34E-04	1.86E-03	3.36E-03	5.65E-03	8.80E-03	1.27E-02	1.74E-02
	118128	12	2.51E-23	9.40E-21	1.00E-18	5.02E-17	1.25E-15	1.90E-14	1.96E-13	1.47E-12	8.80E-12	4.50E-11	2.22E-10	1.09E-09
3s 3p <sup>2</sup> 3p	(CM-1)	WT.												
	0	4	1.06E-00	9.99E-01	9.99E-01	9.99E-01	9.94E-01	9.93E-01	9.89E-01	9.84E-01	9.78E-01	9.73E-01	9.68E-01	9.63E-01
	21167	10	1.84E-04	5.20E-04	1.21E-03	2.44E-03	4.37E-03	7.10E-03	1.07E-02	1.54E-02	2.10E-02	2.76E-02	3.52E-02	4.38E-02
	34975	6	2.22E-07	9.47E-06	5.13E-05	1.61E-04	4.18E-04	9.34E-04	1.86E-03	3.36E-03	5.65E-03	8.80E-03	1.27E-02	1.74E-02
	118128	12	2.51E-23	9.40E-21	1.00E-18	5.02E-17	1.25E-15	1.90E-14	1.96E-13	1.47E-12	8.80E-12	4.50E-11	2.22E-10	1.09E-09
3s 3p <sup>2</sup> 3d	(CM-1)	WT.												
	0	4	1.06E-00	9.99E-01	9.99E-01	9.99E-01	9.94E-01	9.93E-01	9.89E-01	9.84E-01	9.78E-01	9.73E-01	9.68E-01	9.63E-01
	21167	10	1.84E-04	5.20E-04	1.21E-03	2.44E-03	4.37E-03	7.10E-03	1.07E-02	1.54E-02	2.10E-02	2.76E-02	3.52E-02	4.38E-02
	34975	6	2.22E-07	9.47E-06	5.13E-05	1.61E-04	4.18E-04	9.34E-04	1.86E-03	3.36E-03	5.65E-03	8.80E-03	1.27E-02	1.74E-02
	118128	12	2.51E-23	9.40E-21	1.00E-18	5.02E-17	1.25E-15	1.90E-14	1.96E-13	1.47E-12	8.80E-12	4.50E-11	2.22E-10	1.09E-09

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949) AND BOWEN (1955)

TABLE 62 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ar 3+

LEVEL	TEMPERATURE (DEG K)													
	(CM-1)	14090	15000	16000	17000	18000	19000	20000	24000	28000	32000	36000	40000	
0	7.59E-01	7.24E-01	6.96E-01	6.69E-01	6.44E-01	6.21E-01	6.00E-01	5.29E-01	4.74E-01	4.35E-01	4.02E-01	3.74E-01	3.47E-01	
21167	2.14E-01	2.38E-01	2.59E-01	2.79E-01	2.97E-01	3.13E-01	3.17E-01	3.72E-01	4.18E-01	4.70E-01	5.31E-01	6.07E-01	6.97E-01	
34975	3.11E-02	3.78E-02	4.49E-02	5.20E-02	5.90E-02	6.50E-02	7.07E-02	7.77E-02	1.10E-01	1.31E-01	1.59E-01	1.94E-01	2.36E-01	
118128	1.21E-05	2.61E-05	5.08E-05	9.13E-05	0.00016	0.00024	0.00034	0.00046	0.00071	0.00101	0.00136	0.00176	0.00221	
145948	5.74E-07	1.50E-06	3.47E-06	7.21E-06	1.36E-05	2.44E-05	4.13E-05	6.79E-05	0.00012	0.00019	0.00027	0.00036	0.00046	
164719	4.10E-08	1.23E-07	3.22E-07	7.47E-07	1.58E-06	3.04E-06	5.54E-06	9.29E-06	1.54E-05	2.54E-05	4.02E-05	6.07E-05	8.74E-05	
177833	2.74E-09	7.42E-09	2.02E-08	5.49E-08	1.47E-07	3.94E-07	1.01E-06	2.61E-06	6.79E-06	1.74E-05	4.51E-05	1.14E-04	2.87E-04	
209000	1.29E-13	3.62E-13	9.92E-13	2.70E-12	7.20E-12	1.97E-11	5.34E-11	1.44E-10	3.84E-10	1.01E-09	2.64E-09	6.84E-09	1.80E-08	
204000	1.09E-08	2.97E-08	8.11E-08	2.20E-07	6.01E-07	1.61E-06	4.34E-06	1.14E-05	3.04E-05	7.94E-05	2.04E-04	5.24E-04	1.34E-03	
233193	1.70E-11	4.62E-11	1.24E-10	3.34E-10	8.94E-10	2.34E-09	6.24E-09	1.64E-08	4.34E-08	1.14E-07	2.94E-07	7.44E-07	1.94E-06	
290849	1.15E-12	3.07E-12	8.11E-12	2.14E-11	5.74E-11	1.54E-10	4.14E-10	1.14E-09	2.94E-09	7.44E-09	1.94E-08	5.04E-08	1.34E-07	
393000	2.98E-16	8.11E-16	2.14E-15	5.74E-15	1.54E-14	4.14E-14	1.14E-13	2.94E-13	7.44E-13	1.94E-12	5.04E-12	1.34E-11	3.44E-11	
369000	8.04E-16	2.14E-15	5.74E-15	1.54E-14	4.14E-14	1.14E-13	2.94E-13	7.44E-13	1.94E-12	5.04E-12	1.34E-11	3.44E-11	8.74E-11	
241000	1.65E-10	4.42E-10	1.14E-09	3.04E-09	8.11E-09	2.14E-08	5.74E-08	1.54E-07	4.14E-07	1.14E-06	2.94E-06	7.44E-06	1.94E-05	
268159	2.03E-12	5.42E-12	1.44E-11	3.84E-11	1.01E-10	2.61E-10	6.84E-10	1.84E-09	4.84E-09	1.24E-08	3.24E-08	8.34E-08	2.14E-07	
307000	1.12E-13	2.97E-13	7.81E-13	2.14E-12	5.74E-12	1.54E-11	4.14E-11	1.14E-10	2.94E-10	7.44E-10	1.94E-09	5.04E-09	1.34E-08	
348000	3.55E-16	9.62E-16	2.54E-15	6.84E-15	1.84E-14	4.94E-14	1.34E-13	3.54E-13	9.24E-13	2.44E-12	6.44E-12	1.74E-11	4.54E-11	
344000	9.59E-17	2.54E-16	6.84E-16	1.84E-15	4.94E-15	1.34E-14	3.54E-14	9.24E-14	2.44E-13	6.44E-13	1.74E-12	4.54E-12	1.14E-11	
255000	7.94E-12	2.14E-11	5.74E-11	1.54E-10	4.14E-10	1.14E-09	2.94E-09	7.44E-09	1.94E-08	5.04E-08	1.34E-07	3.44E-07	8.74E-07	
378000	8.12E-17	2.14E-16	5.74E-16	1.54E-15	4.14E-15	1.14E-14	2.94E-14	7.44E-14	1.94E-13	5.04E-13	1.34E-12	3.44E-12	8.74E-12	

LEVEL	TEMPERATURE (DEG K)													
	(CM-1)	44000	48000	60000	80000	100000	200000	400000	600000	1000000	0	0	0	
0	3.50E-01	3.28E-01	3.05E-01	2.71E-01	1.93E-01	1.36E-01	3.99E-02	1.64E-02	1.18E-02	8.93E-03	0.	0.	0.	
21167	4.30E-01	4.05E-01	3.78E-01	3.40E-01	2.51E-01	1.73E-01	8.57E-02	3.79E-02	2.79E-02	2.17E-02	0.	0.	0.	
34975	1.67E-01	1.73E-01	1.74E-01	1.74E-01	1.54E-01	1.23E-01	6.65E-02	2.16E-02	1.62E-02	1.27E-02	0.	0.	0.	
118128	2.21E-02	2.85E-02	3.65E-02	4.78E-02	6.91E-02	1.01E-01	1.52E-01	2.21E-01	3.21E-01	4.81E-01	0.	0.	0.	
145948	7.40E-03	1.03E-02	1.36E-02	1.84E-02	2.44E-02	3.24E-02	4.34E-02	5.74E-02	7.44E-02	9.64E-02	0.	0.	0.	
164719	2.25E-03	3.33E-03	4.94E-03	7.44E-03	1.14E-02	1.74E-02	2.54E-02	3.64E-02	5.14E-02	7.04E-02	0.	0.	0.	
177833	5.22E-04	7.94E-04	1.14E-03	1.74E-03	2.54E-03	3.64E-03	5.14E-03	7.04E-03	9.64E-03	0.00011	0.	0.	0.	
209000	4.00E-03	6.24E-03	9.14E-03	1.34E-02	1.94E-02	2.84E-02	4.04E-02	5.64E-02	7.74E-02	0.00013	0.	0.	0.	
204000	9.34E-03	1.44E-02	2.14E-02	3.14E-02	4.64E-02	6.84E-02	1.01E-01	1.44E-01	2.14E-01	3.14E-01	0.	0.	0.	
233193	4.00E-04	7.44E-04	1.14E-03	1.74E-03	2.54E-03	3.64E-03	5.14E-03	7.04E-03	9.64E-03	0.00014	0.	0.	0.	
290849	3.59E-04	7.42E-04	1.14E-03	1.74E-03	2.54E-03	3.64E-03	5.14E-03	7.04E-03	9.64E-03	0.00016	0.	0.	0.	
393000	7.64E-05	1.87E-04	4.22E-04	9.62E-04	2.14E-03	4.94E-03	1.14E-02	2.61E-02	5.74E-02	1.24E-01	0.	0.	0.	
369000	6.34E-05	1.62E-04	3.62E-04	8.11E-04	1.84E-03	4.14E-03	9.24E-03	2.04E-02	4.54E-02	1.01E-01	0.	0.	0.	
241000	1.65E-03	2.99E-03	5.09E-03	8.94E-03	1.44E-02	2.34E-02	3.84E-02	6.14E-02	9.94E-02	0.00016	0.	0.	0.	
268159	1.34E-04	2.65E-04	4.94E-04	9.14E-04	1.74E-03	3.24E-03	6.04E-03	1.14E-02	2.14E-02	4.04E-02	0.	0.	0.	
307000	1.15E-04	2.48E-04	5.24E-04	1.14E-03	2.44E-03	5.14E-03	1.01E-02	2.04E-02	4.24E-02	8.74E-02	0.	0.	0.	
348000	2.60E-05	6.44E-05	1.64E-04	4.14E-04	1.01E-03	2.44E-03	5.74E-03	1.34E-02	3.04E-02	6.54E-02	0.	0.	0.	
344000	2.14E-05	5.34E-05	1.34E-04	3.34E-04	8.11E-04	1.94E-03	4.64E-03	1.14E-02	2.64E-02	5.74E-02	0.	0.	0.	
255000	2.09E-04	3.93E-04	7.44E-04	1.44E-03	2.84E-03	5.64E-03	1.14E-02	2.24E-02	4.34E-02	8.34E-02	0.	0.	0.	
378000	1.20E-05	3.15E-05	7.81E-05	1.94E-04	4.84E-04	1.24E-03	3.04E-03	7.44E-03	1.84E-02	4.54E-02	0.	0.	0.	



TABLE 63. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C II

STATE	LEVEL (CM-1)	LEVEL (EV)	STAT. WT.	TEMPERATURE (DEG K)									
				5200	5400	6000	6400	6800	7200	7600	8000	8400	8800
1s	0	0.	1	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
2s	2411244	298.9484	3	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p	2556000	304.4973	1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3s	2442215	305.2679	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3p	2861000	352.2300	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3d	2857000	354.2137	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4s	2858000	354.3377	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4p	2467760	370.3312	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4d	2939000	370.7032	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4f	2991000	370.8272	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5s	2991000	370.8272	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL (CM-1)	LEVEL (EV)	TEMPERATURE (DEG K)									
		8800	9200	9600	10000	10400	10800	11200	11600	12000	12400
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
2411244	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2456000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2442215	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2861000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2857000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2858000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2467760	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2939000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2991000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
MONITORING ENERGY LEVELS FROM MOORE (1949) AND EDLEN (1952)

TABLE 63 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C 4+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	19000	20000	24000	28000	32000	36000	40000	44000	60000	100000
0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
2411244	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2454000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2462215	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2461000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2857000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2858000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2887000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2990000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2991000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2991000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	1000000	2000000	4000000	6000000	10000000	0	0
0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
2411244	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2454000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2462215	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2461000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2857000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2858000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2887000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2990000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2991000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2991000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TABLE 64. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N<sup>++</sup>

STATE	LEVEL		STAT.	TEMPERATURE (DEG K)									
	(CM-1)	(EV)		WT.	5200	5600	6000	6400	6800	7200	7600	8000	8400
1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup>	0	0.	2	1.20E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
	80637	4.9975	4	6.13E-10	3.02E-09	1.20E-08	4.02E-08	1.17E-07	3.01E-07	7.04E-07	1.51E-06	3.61E-06	
	456127	56.5511	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	477851	59.2444	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	484413	60.0590	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	
4s <sup>2</sup>	606343	75.1750	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	615135	76.2651	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	617908	76.6089	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	619050*	76.6265	14	0.	0.	0.	0.	0.	0.	0.	0.	0.	
	0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
				TEMPERATURE (DEG K)									
1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup>	(CM-1)	8800	9200	9600	10000	11000	12000	13000	14000	15000	16000	17000	18000
	0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
	80637	5.64E-06	1.00E-05	1.69E-05	2.74E-05	7.88E-05	1.90E-04	3.99E-04	7.55E-04	9.99E-04	9.97E-04	9.99E-04	9.99E-04
	456127	4.09E-33	1.05E-31	2.09E-30	3.15E-29	1.23E-26	1.77E-24	1.19E-22	4.30E-21	9.94E-20	2.13E-03	3.25E-03	4.74E-03
	477851	3.52E-34	1.05E-32	2.37E-31	4.15E-30	2.15E-27	3.93E-25	3.23E-23	1.51E-21	3.72E-20	1.53E-18	1.54E-16	1.54E-14
4s <sup>2</sup>	484413	2.01E-34	6.29E-33	1.48E-31	2.59E-30	1.52E-27	2.98E-25	2.60E-23	1.20E-21	3.30E-20	6.52E-19	8.16E-18	7.70E-17
	606343	0.	0.	0.	1.29E-38	3.60E-35	2.67E-32	7.17E-30	8.69E-28	5.51E-26	2.09E-24	7.60E-23	7.60E-21
	615135	0.	0.	0.	0.	3.42E-35	2.79E-32	8.13E-30	1.05E-27	7.11E-26	2.84E-24	3.15E-23	3.15E-21
	617908	0.	0.	0.	0.	3.97E-35	3.34E-32	9.96E-30	1.32E-27	9.08E-26	3.69E-24	4.07E-23	4.07E-21
	619050	0.	0.	0.	0.	5.45E-35	4.59E-32	1.37E-29	1.82E-27	1.23E-25	5.09E-24	1.36E-22	2.44E-21

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM MCORE (1969) AND TILFORD (1963)

TABLE 64 (CONT.) 1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N II

LFVEL (CM-1)	TEMPERATURE (DEG K)									
	17000	20000	24000	28000	32000	36000	40000	44000	48000	52000
0	9.93E-01	9.91E-01	9.77E-01	9.59E-01	9.26E-01	8.93E-01	8.58E-01	8.23E-01	7.87E-01	7.51E-01
80637	6.64E-03	5.99E-03	5.33E-03	4.54E-03	3.62E-03	2.70E-03	1.78E-03	8.6E-04	3.5E-04	1.5E-04
456127	3.92E-16	5.56E-15	1.30E-12	5.32E-11	1.15E-09	1.08E-08	6.43E-08	2.74E-07	9.10E-07	3.03E-06
477851	5.74E-16	3.50E-15	1.76E-12	6.71E-11	1.30E-09	1.36E-08	8.83E-08	4.04E-07	1.42E-06	5.21E-06
484413	5.82E-16	3.64E-15	1.19E-12	7.39E-11	1.61E-09	1.75E-08	1.18E-07	5.43E-07	1.95E-06	7.41E-06
606343	1.14E-20	1.13E-19	1.60E-16	2.31E-14	1.34E-12	2.67E-11	2.90E-10	2.02E-09	1.01E-08	3.38E-07
615135	1.75E-20	1.80E-19	2.83E-16	5.14E-14	2.70E-12	5.64E-11	6.33E-10	4.54E-09	2.32E-08	8.21E-07
617938	2.37E-20	2.43E-19	3.97E-16	7.15E-14	3.98E-12	8.41E-11	9.55E-10	6.91E-09	3.57E-08	1.24E-07
618050	3.24E-20	4.06E-19	5.54E-16	1.08E-13	5.64E-12	1.17E-10	1.33E-09	9.63E-09	4.97E-08	1.79E-07

LFVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	1000000	2000000	4000000	6000000	10000000	0	0
0	3.17E-01	1.52E-01	1.00E-01	6.77E-02	4.88E-02	4.11E-02	3.86E-02	3.70E-02	0.	0.
80157	5.32E-01	3.40E-01	2.48E-01	1.31E-01	1.38E-01	1.20E-01	1.14E-01	1.10E-01	0.	0.
456127	1.19E-02	2.94E-02	3.36E-02	3.51E-02	3.52E-02	3.45E-02	3.44E-02	3.47E-02	0.	0.
477851	3.04E-02	8.14E-02	9.56E-02	1.02E-01	1.04E-01	1.04E-01	1.04E-01	1.04E-01	0.	0.
484413	4.86E-02	1.33E-01	1.57E-01	1.69E-01	1.72E-01	1.73E-01	1.73E-01	1.73E-01	0.	0.
606343	4.04E-03	1.71E-02	2.34E-02	2.81E-02	3.16E-02	3.31E-02	3.36E-02	3.39E-02	0.	0.
615135	1.14E-02	4.98E-02	6.88E-02	8.30E-02	9.41E-02	9.89E-02	1.00E-01	1.02E-01	0.	0.
617938	1.84E-02	8.22E-02	1.14E-01	1.39E-01	1.57E-01	1.65E-01	1.67E-01	1.68E-01	0.	0.
618050	2.60E-02	1.15E-01	1.59E-01	1.93E-01	2.19E-01	2.31E-01	2.34E-01	2.37E-01	0.	0.

TABLE 65. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF D 4\*

STATE	LEVEL	STAT.	TEMPERATURE (DEG K)											
			5200	5600	6000	6400	6800	7200	7600	8000	8400			
2s	15	1	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00		
			1.12E-09	5.73E-09	2.35E-08	8.09E-08	2.41E-07	6.34E-07	1.51E-06	3.29E-06	6.44E-06	1.19E-12		
			2.48E-19	5.73E-18	8.70E-17	9.40E-16	7.67E-15	4.96E-14	2.64E-13	1.19E-12	4.42E-12	1.10E-15		
			1.77E-25	1.21E-23	4.73E-22	1.17E-20	1.98E-19	2.44E-18	2.32E-17	1.76E-16	1.10E-15	2.90E-17		
			7.15E-28	6.97E-26	3.69E-24	1.19E-22	2.55E-21	3.88E-20	4.44E-19	3.98E-18	2.90E-17	2.90E-17		
			2.53E-35	7.49E-33	1.04E-30	7.77E-29	3.50E-27	1.03E-25	2.13E-24	3.25E-23	3.83E-22	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
2p	15	1	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00		
			1.12E-09	5.73E-09	2.35E-08	8.09E-08	2.41E-07	6.34E-07	1.51E-06	3.29E-06	6.44E-06	1.19E-12		
			2.48E-19	5.73E-18	8.70E-17	9.40E-16	7.67E-15	4.96E-14	2.64E-13	1.19E-12	4.42E-12	1.10E-15		
			1.77E-25	1.21E-23	4.73E-22	1.17E-20	1.98E-19	2.44E-18	2.32E-17	1.76E-16	1.10E-15	2.90E-17		
			7.15E-28	6.97E-26	3.69E-24	1.19E-22	2.55E-21	3.88E-20	4.44E-19	3.98E-18	2.90E-17	2.90E-17		
			2.53E-35	7.49E-33	1.04E-30	7.77E-29	3.50E-27	1.03E-25	2.13E-24	3.25E-23	3.83E-22	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
3s	15	1	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00		
			1.12E-09	5.73E-09	2.35E-08	8.09E-08	2.41E-07	6.34E-07	1.51E-06	3.29E-06	6.44E-06	1.19E-12		
			2.48E-19	5.73E-18	8.70E-17	9.40E-16	7.67E-15	4.96E-14	2.64E-13	1.19E-12	4.42E-12	1.10E-15		
			1.77E-25	1.21E-23	4.73E-22	1.17E-20	1.98E-19	2.44E-18	2.32E-17	1.76E-16	1.10E-15	2.90E-17		
			7.15E-28	6.97E-26	3.69E-24	1.19E-22	2.55E-21	3.88E-20	4.44E-19	3.98E-18	2.90E-17	2.90E-17		
			2.53E-35	7.49E-33	1.04E-30	7.77E-29	3.50E-27	1.03E-25	2.13E-24	3.25E-23	3.83E-22	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
3p	15	1	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00		
			1.12E-09	5.73E-09	2.35E-08	8.09E-08	2.41E-07	6.34E-07	1.51E-06	3.29E-06	6.44E-06	1.19E-12		
			2.48E-19	5.73E-18	8.70E-17	9.40E-16	7.67E-15	4.96E-14	2.64E-13	1.19E-12	4.42E-12	1.10E-15		
			1.77E-25	1.21E-23	4.73E-22	1.17E-20	1.98E-19	2.44E-18	2.32E-17	1.76E-16	1.10E-15	2.90E-17		
			7.15E-28	6.97E-26	3.69E-24	1.19E-22	2.55E-21	3.88E-20	4.44E-19	3.98E-18	2.90E-17	2.90E-17		
			2.53E-35	7.49E-33	1.04E-30	7.77E-29	3.50E-27	1.03E-25	2.13E-24	3.25E-23	3.83E-22	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
			0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949)

TABLE 65 (CONT.-1). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O 4+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	19000	20000	24000	28000	32000	36000	40000	44000	48000	100000
0	9.83E-01	9.77E-01	9.39E-01	9.84E-01	8.17E-01	7.45E-01	6.76E-01	6.11E-01	5.54E-01	2.14E-01
82413	1.72E-02	2.34E-02	6.04E-02	1.15E-01	2.49E-01	3.15E-01	3.14E-01	3.72E-01	4.21E-01	5.85E-01
158798	1.77E-05	3.20E-05	2.07E-04	1.94E-04	1.94E-03	3.32E-03	6.70E-03	1.02E-02	1.52E-02	6.53E-02
213929	8.15E-07	1.82E-06	2.28E-05	1.34E-04	4.89E-04	1.30E-03	2.77E-03	5.04E-03	8.18E-03	5.50E-02
231722	1.10E-07	2.81E-07	4.59E-06	2.98E-05	1.22E-04	3.54E-04	8.11E-04	1.57E-03	2.66E-03	3.81E-02
287909	3.34E-10	9.88E-10	3.00E-08	1.32E-07	1.95E-06	2.50E-06	2.15E-05	4.98E-05	9.49E-05	3.39E-03
550682	3.05E-18	2.44E-17	7.73E-14	1.82E-12	5.77E-11	8.24E-10	7.75E-09	3.70E-08	1.50E-07	5.72E-06
582501	8.22E-19	7.41E-18	7.69E-15	1.08E-12	4.74E-11	6.81E-10	6.45E-09	3.92E-08	1.74E-07	9.65E-06
656197	2.72E-19	2.86E-18	3.56E-15	7.71E-13	2.64E-11	4.82E-10	6.99E-09	3.25E-08	1.31E-07	7.20E-06
724916	5.64E-24	8.76E-23	5.02E-19	2.35E-16	2.68E-14	7.80E-13	1.29E-11	1.24E-10	8.10E-10	2.52E-05
736558	7.05E-24	1.14E-22	7.50E-19	3.87E-16	4.04E-14	1.47E-12	2.53E-11	2.54E-10	1.71E-09	4.07E-06
743379	7.01E-24	1.16E-22	8.31E-19	4.59E-16	4.27E-14	1.86E-12	3.90E-11	3.84E-10	2.31E-09	1.52E-07
749857	6.01E-24	1.02E-22	7.89E-19	4.57E-16	5.21E-14	2.01E-12	3.66E-11	3.84E-10	2.68E-09	1.84E-07
844352	1.10E-21	1.46E-20	9.28E-17	2.41E-14	1.51E-12	3.55E-11	4.96E-10	3.52E-09	1.91E-08	7.37E-07
703506	4.31E-22	2.72E-17	1.06E-14	8.97E-13	2.75E-11	4.15E-10	3.75E-09	2.31E-08	1.18E-06	5.50E-05
824280	9.19E-27	2.07E-25	3.90E-21	4.27E-18	7.86E-16	4.41E-14	1.08E-12	1.44E-11	1.24E-10	1.31E-08
831186	1.40E-26	3.27E-25	6.86E-21	8.11E-18	1.58E-15	9.27E-14	2.39E-12	3.24E-11	2.84E-10	3.17E-08
845389	9.29E-27	2.27E-25	5.40E-21	7.22E-18	1.52E-15	9.80E-14	2.52E-12	3.62E-11	3.28E-10	3.95E-08
853000	7.31E-27	1.84E-25	4.88E-21	6.94E-18	1.51E-15	9.80E-14	2.69E-12	3.95E-11	3.66E-10	4.60E-08
0	8.37E-02	2.33E-02	1.18E-02	6.39E-03	3.90E-03	3.03E-03	2.78E-03	2.59E-03	0.	0.
82413	4.16E-01	1.56E-01	8.73E-02	5.11E-02	3.31E-02	2.64E-02	2.45E-02	2.31E-02	0.	0.
158798	8.01E-02	3.94E-02	2.42E-02	1.53E-02	1.04E-02	8.58E-03	8.02E-03	7.60E-03	0.	0.
213929	1.62E-01	9.70E-02	6.37E-02	4.25E-02	3.01E-02	2.32E-02	2.38E-02	2.26E-02	0.	0.
231722	7.90E-02	5.06E-02	3.39E-02	2.29E-02	1.65E-02	1.39E-02	1.31E-02	1.25E-02	0.	0.
287909	1.04E-02	8.24E-03	5.93E-03	4.22E-03	3.17E-03	2.73E-03	2.59E-03	2.49E-03	0.	0.
550682	6.37E-03	1.28E-02	1.26E-02	1.15E-02	1.05E-02	9.93E-03	9.74E-03	9.50E-03	0.	0.
582501	1.52E-02	3.44E-02	3.51E-02	3.32E-02	3.08E-02	2.95E-02	2.90E-02	2.86E-02	0.	0.
603862	2.17E-02	5.30E-02	5.56E-02	5.36E-02	5.06E-02	4.87E-02	4.81E-02	4.75E-02	0.	0.
724916	1.82E-03	6.86E-03	8.32E-03	9.01E-03	9.27E-03	9.33E-03	9.34E-03	9.34E-03	0.	0.
736558	5.02E-03	1.97E-02	2.43E-02	2.54E-02	2.76E-02	2.79E-02	2.79E-02	2.80E-02	0.	0.
743379	7.97E-03	3.21E-02	3.98E-02	4.39E-02	4.57E-02	4.63E-02	4.65E-02	4.66E-02	0.	0.
749857	1.04E-02	4.39E-02	5.48E-02	6.09E-02	6.37E-02	6.47E-02	6.50E-02	6.52E-02	0.	0.
656197	8.95E-03	2.64E-02	2.94E-02	2.98E-02	2.92E-02	2.87E-02	2.85E-02	2.83E-02	0.	0.
684352	2.19E-02	7.15E-02	8.25E-02	6.60E-02	8.59E-02	8.52E-02	8.49E-02	8.46E-02	0.	0.
703506	3.10E-02	1.11E-01	1.31E-01	1.39E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	0.	0.
824280	2.67E-03	1.44E-02	1.97E-02	2.34E-02	2.59E-02	2.70E-02	2.74E-02	2.76E-02	0.	0.
831186	7.52E-03	4.18E-02	5.77E-02	6.94E-02	7.72E-02	8.08E-02	8.19E-02	8.28E-02	0.	0.
845389	1.15E-02	4.67E-02	9.34E-02	1.14E-01	1.28E-01	1.34E-01	1.34E-01	1.38E-01	0.	0.
853000	1.52E-02	9.09E-02	1.28E-01	1.57E-01	1.78E-01	1.87E-01	1.90E-01	1.93E-01	0.	0.

TABLE 66. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR ++

STATE	LEVEL	STAT.	TEMPERATURE (DEG K)									
			5200	5600	6000	6400	6800	7200	7600	8000	8400	
$3s^2 3p^2$ $^3P$ $^3P_1$ $^3P_2$ $^3P_0$	0	1	1.56E-01	1.94E-01	1.50E-01	1.47E-01	1.44E-01	1.41E-01	1.38E-01	1.36E-01	1.34E-01	
	765	3	3.93E-01	3.79E-01	3.74E-01	3.70E-01	3.66E-01	3.63E-01	3.59E-01	3.56E-01	3.52E-01	
	2032	5	4.50E-01	4.56E-01	4.61E-01	4.64E-01	4.67E-01	4.69E-01	4.71E-01	4.72E-01	4.73E-01	
	16301	5	8.68E-03	1.17E-02	1.50E-02	1.88E-02	2.28E-02	2.71E-02	3.16E-02	3.63E-02	4.10E-02	
	37914	1	4.39E-06	9.04E-06	1.69E-05	2.91E-05	4.71E-05	7.22E-05	1.04E-04	1.49E-04	2.02E-04	
$3s 3p^3$ $^4P$ $^4P_1$ $^4P_2$ $^4P_0$	100000*	5	7.40E-13	5.34E-12	2.89E-11	1.26E-10	4.63E-10	1.48E-09	4.15E-09	1.09E-08	2.44E-08	
	121730	15	5.58E-15	6.02E-14	4.73E-13	2.87E-12	1.40E-11	5.76E-11	2.04E-10	6.33E-10	1.77E-09	
	141768	9	1.31E-17	2.10E-16	2.32E-15	1.90E-14	1.21E-13	6.30E-13	2.75E-12	1.03E-11	3.43E-11	
	191537	3	4.57E-24	1.96E-22	5.08E-21	8.76E-20	1.08E-18	1.01E-17	7.42E-17	4.47E-16	2.27E-15	
	160000*	5	4.69E-20	1.08E-18	1.63E-17	1.75E-16	1.42E-15	9.16E-15	4.84E-14	2.16E-13	8.39E-13	
$3s^2 3p^2$ $^3P$ $^3P_1$ $^3P_2$ $^3P_0$	195356	3	1.59E-24	7.34E-23	2.03E-21	3.71E-20	4.82E-19	4.70E-18	3.40E-17	2.29E-16	1.18E-15	
	270000*	15	8.51E-33	1.72E-30	1.71E-28	9.57E-27	3.33E-25	7.81E-24	1.31E-22	1.66E-21	1.65E-20	
	220000*	60	3.47E-26	2.61E-24	1.10E-22	2.92E-21	5.24E-20	6.82E-19	6.78E-18	5.35E-17	3.44E-16	
	294155	12	2.82E-36	9.93E-34	1.40E-31	1.37E-29	6.90E-28	2.25E-26	5.09E-25	8.41E-24	1.04E-22	
	340000*	36	0.	6.38E-30	2.11E-25	3.34E-23	2.94E-21	1.58E-23	5.53E-28	1.36E-26	2.46E-25	
$3s 3p^3$ $^4P$ $^4P_1$ $^4P_2$ $^4P_0$	400000*	60	0.	0.	0.	0.	1.51E-36	1.63E-34	1.08E-32	4.67E-31	1.41E-29	
	420000*	84	0.	0.	0.	0.	0.	4.20E-36	3.42E-34	1.79E-32	6.43E-31	
	500000*	300	4.23E-35	1.55E-32	2.57E-30	2.25E-28	1.17E-26	3.69E-25	8.97E-24	1.51E-22	1.94E-21	
	380000*	60	0.	0.	0.	0.	6.97E-37	1.04E-34	4.74E-31	1.70E-29	4.56E-28	
	430000*	180	0.	0.	0.	0.	0.	1.22E-36	1.10E-34	6.35E-33	2.48E-31	
$3s 3p^3$ $^4P$ $^4P_1$ $^4P_2$ $^4P_0$	500000*	300	0.	0.	0.	0.	0.	0.	0.	0.	2.57E-34	
	520000*	420	0.	0.	0.	0.	0.	0.	0.	0.	0.	

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949) AND BOWEN (1955)

TABLE 66 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 4+

LEVEL	TEMPERATURE (DEG K)											
	8000	9200	9600	10000	11000	12000	13000	14000	15000	16000	17000	18000
0	1.32E-01	1.30E-01	1.28E-01	1.27E-01	1.23E-01	1.17E-01	1.16E-01	1.14E-01	1.11E-01	1.09E-01	1.07E-01	1.05E-01
765	3.49E-01	3.40E-01	3.43E-01	3.40E-01	3.33E-01	3.27E-01	3.21E-01	3.16E-01	3.11E-01	3.08E-01	3.02E-01	2.98E-01
2032	4.73E-01	4.73E-01	4.73E-01	4.72E-01	4.70E-01	4.68E-01	4.68E-01	4.62E-01	4.58E-01	4.55E-01	4.52E-01	4.48E-01
16301	4.59E-02	5.08E-02	5.57E-02	6.06E-02	7.28E-02	8.48E-02	9.58E-02	1.07E-01	1.17E-01	1.26E-01	1.34E-01	1.41E-01
37914	2.68E-04	3.46E-04	4.37E-04	5.41E-04	6.62E-04	1.27E-03	1.79E-03	2.31E-03	2.93E-03	3.61E-03	4.33E-03	5.09E-03
100000	5.23E-08	1.09E-07	1.99E-07	3.57E-07	1.28E-06	3.71E-06	9.09E-06	1.96E-05	3.80E-05	6.79E-05	1.13E-04	1.78E-04
121730	4.49E-09	1.05E-08	2.29E-08	4.70E-08	2.24E-07	8.21E-07	2.44E-06	6.30E-06	1.62E-05	2.89E-05	5.40E-05	9.41E-05
141768	1.02E-10	2.75E-10	6.83E-10	1.58E-09	9.77E-09	4.48E-08	1.61E-07	4.82E-07	1.25E-06	2.86E-06	5.94E-06	1.14E-05
191537	9.93E-15	3.82E-14	1.31E-13	4.09E-13	4.85E-12	3.81E-11	2.17E-10	9.65E-10	3.51E-09	1.08E-08	2.93E-08	7.10E-08
287000	2.87E-12	8.83E-12	2.47E-11	6.36E-11	5.00E-10	2.78E-09	1.19E-08	4.11E-08	1.20E-07	3.08E-07	7.05E-07	1.47E-06
393356	5.32E-15	2.10E-14	7.40E-14	2.36E-13	2.94E-12	2.11E-11	1.42E-10	6.52E-10	2.43E-09	7.69E-09	2.12E-08	5.23E-08
5770000	1.37E-19	6.95E-19	5.13E-18	2.55E-17	6.47E-16	1.56E-14	1.84E-13	1.52E-12	9.45E-12	6.68E-11	1.92E-10	6.70E-10
7220000	1.59E-15	6.91E-15	3.68E-14	1.36E-13	2.34E-12	2.51E-11	1.84E-10	1.04E-09	4.58E-09	1.68E-08	5.28E-08	1.46E-07
898155	1.07E-21	8.76E-21	6.03E-20	3.56E-19	1.70E-17	4.27E-16	6.52E-15	6.73E-14	5.08E-13	2.98E-12	1.41E-11	5.65E-11
940000	3.42E-24	3.78E-23	3.62E-22	2.59E-21	2.15E-19	9.49E-18	1.91E-16	2.74E-15	2.75E-14	2.07E-13	1.23E-12	5.98E-12
1000000	3.13E-28	5.30E-27	7.08E-26	7.59E-25	1.40E-23	1.04E-20	4.15E-19	9.58E-18	1.45E-16	1.57E-15	1.28E-14	8.23E-14
1200000	1.67E-29	3.23E-28	4.95E-27	6.06E-26	1.31E-23	1.39E-21	6.35E-20	1.72E-18	2.59E-17	3.63E-16	3.28E-15	2.33E-14
1500000	1.97E-20	1.64E-19	1.14E-18	6.52E-18	3.35E-16	8.58E-15	1.35E-13	1.38E-12	1.64E-11	6.30E-11	3.03E-10	1.22E-09
1800000	8.24E-27	1.21E-25	1.42E-24	1.37E-23	1.91E-21	1.17E-19	3.78E-18	7.48E-17	9.89E-16	9.47E-15	6.94E-14	4.07E-13
2100000	6.96E-30	1.46E-28	2.37E-27	3.08E-26	8.28E-24	8.74E-22	4.50E-20	1.32E-18	2.45E-17	3.11E-16	3.02E-15	2.24E-14
2500000	1.24E-34	4.28E-33	1.10E-31	2.17E-30	1.46E-27	3.30E-25	3.24E-23	1.65E-21	4.56E-20	9.74E-19	1.35E-17	1.39E-16
2900000	6.61E-36	2.62E-34	7.67E-33	1.71E-31	1.49E-28	4.20E-26	4.94E-24	2.95E-22	1.02E-20	2.26E-19	3.47E-18	3.93E-17



TABLE 66 (CONT.) 1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ar ++

LEVEL (CM-1)	TEMPERATURE (DEG K)											
	13000	20000	24000	28000	32000	36000	40000	44000	48000	52000	60000	100000
0	1.04E-01	1.02E-01	9.71E-02	9.29E-02	8.94E-02	8.62E-02	8.31E-02	8.01E-02	7.70E-02	6.75E-02	5.04E-02	3.50E-02
765	2.94E-01	2.90E-01	2.78E-01	2.68E-01	2.59E-01	2.51E-01	2.43E-01	2.34E-01	2.26E-01	1.99E-01	1.50E-01	1.04E-01
2032	4.45E-01	4.42E-01	4.30E-01	4.19E-01	4.08E-01	3.97E-01	3.86E-01	3.75E-01	3.62E-01	3.21E-01	2.44E-01	1.74E-01
16201	1.51E-01	1.50E-01	1.43E-01	1.37E-01	1.31E-01	1.25E-01	1.19E-01	1.13E-01	1.07E-01	9.28E-02	7.89E-02	6.42E-02
37914	5.88E-03	6.69E-03	1.00E-02	1.32E-02	1.53E-02	1.89E-02	2.12E-02	2.32E-02	2.47E-02	2.72E-02	2.94E-02	2.07E-02
100000	2.67E-04	3.84E-04	1.21E-03	2.73E-03	4.98E-03	7.92E-03	1.14E-02	1.52E-02	1.92E-02	3.07E-02	4.19E-02	4.24E-02
121730	1.44E-04	2.41E-04	9.68E-04	2.68E-03	5.93E-03	9.77E-03	1.54E-02	2.24E-02	3.01E-02	5.64E-02	8.50E-02	9.32E-02
141768	2.03E-05	3.43E-05	1.78E-04	5.74E-04	1.37E-03	2.68E-03	4.54E-03	6.79E-03	9.89E-03	2.03E-02	3.54E-02	4.19E-02
191537	1.56E-07	3.10E-07	3.00E-06	1.48E-05	4.68E-05	1.22E-04	2.54E-04	4.50E-04	7.42E-04	2.02E-03	4.83E-03	8.82E-03
160000	2.84E-06	5.13E-06	3.31E-05	1.25E-04	3.56E-04	7.20E-04	1.32E-03	2.14E-03	3.18E-03	7.27E-03	1.42E-02	1.74E-02
193356	1.17E-07	2.42E-07	2.39E-06	1.22E-05	4.11E-05	1.05E-04	2.21E-04	4.04E-04	6.62E-04	1.87E-03	4.52E-03	6.44E-03
270000	2.05E-09	5.63E-09	1.36E-07	1.31E-06	7.16E-06	2.66E-05	7.53E-05	1.74E-04	3.53E-04	1.56E-03	5.91E-03	1.10E-02
220000	3.62E-07	8.21E-07	1.09E-05	6.87E-05	2.71E-04	7.85E-04	1.82E-03	3.61E-03	6.32E-03	2.07E-02	5.81E-02	9.04E-02
298155	1.95E-10	5.94E-10	2.01E-08	2.47E-07	1.62E-06	6.91E-06	2.19E-05	5.60E-05	1.21E-04	6.36E-04	2.89E-03	5.89E-03
340000	2.46E-11	8.78E-11	4.91E-09	8.65E-08	7.39E-07	3.89E-06	1.44E-05	4.28E-05	1.04E-04	6.99E-04	4.03E-03	9.57E-03
400000	4.36E-13	1.95E-12	2.24E-10	6.60E-09	8.29E-08	5.90E-07	2.81E-06	1.00E-05	2.87E-05	2.76E-04	2.26E-03	6.89E-03
420000	1.34E-13	6.49E-13	9.47E-11	3.31E-09	4.72E-08	3.71E-07	1.92E-06	7.32E-06	2.21E-05	2.40E-04	2.23E-03	7.14E-03
300000	4.24E-09	1.30E-08	4.50E-07	5.63E-06	3.72E-05	1.40E-04	5.13E-04	1.32E-03	2.87E-03	1.52E-02	6.89E-02	1.43E-01
360000	1.80E-12	8.23E-12	7.44E-10	1.85E-08	2.04E-07	1.31E-06	5.77E-06	1.93E-05	5.23E-05	4.64E-04	3.21E-03	9.07E-03
430000	1.55E-13	6.77E-13	1.11E-10	4.24E-09	6.46E-08	5.33E-07	2.87E-06	1.13E-05	3.50E-05	4.04E-04	3.99E-03	1.32E-02
500000	1.12E-15	7.33E-15	2.79E-12	1.94E-10	4.62E-09	5.42E-08	3.89E-07	1.91E-06	7.14E-06	1.26E-04	1.89E-03	8.04E-03
520000	3.45E-16	2.44E-15	1.10E-12	9.70E-11	2.63E-09	3.41E-08	2.63E-07	1.39E-06	5.50E-06	1.09E-04	1.84E-03	8.47E-03

TABLE 66 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 4+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	1000000	2000000	4000000	6000000	10000000	10000000	0
0	8.30E-03	2.57E-03	1.65E-03	1.11E-03	8.49E-04	7.33E-04	6.98E-04	6.71E-04	0.	0.
765	2.48E-02	7.69E-03	4.93E-03	3.40E-03	2.55E-03	2.20E-03	2.09E-03	2.01E-03	0.	0.
7037	4.09E-02	1.28E-02	8.19E-03	5.65E-03	4.24E-03	3.66E-03	3.49E-03	3.35E-03	0.	0.
16301	3.69E-02	1.21E-02	7.91E-03	5.53E-03	4.20E-03	3.65E-03	3.48E-03	3.35E-03	0.	0.
37914	6.37E-03	2.24E-03	1.50E-03	1.07E-03	8.26E-04	7.23E-04	6.92E-04	6.67E-04	0.	0.
100000	2.02E-02	8.96E-03	6.47E-03	4.91E-03	3.95E-03	3.54E-03	3.41E-03	3.31E-03	0.	0.
121740	5.19E-02	2.49E-02	1.84E-02	1.43E-02	1.17E-02	1.05E-02	1.02E-02	9.89E-03	0.	0.
141748	2.69E-02	1.39E-02	1.05E-02	8.32E-03	6.90E-03	6.27E-03	6.07E-03	5.92E-03	0.	0.
191537	6.28E-03	3.87E-03	3.12E-03	2.58E-03	2.22E-03	2.05E-03	2.00E-03	1.94E-03	0.	0.
160000	1.31E-02	7.22E-03	5.61E-03	4.50E-03	3.78E-03	3.46E-03	3.36E-03	3.28E-03	0.	0.
195356	6.11E-03	3.87E-03	3.09E-03	2.57E-03	2.21E-03	2.03E-03	2.00E-03	1.94E-03	0.	0.
270000	1.78E-02	1.44E-02	1.29E-02	1.15E-02	1.05E-02	9.98E-03	9.81E-03	9.68E-03	0.	0.
220000	1.07E-01	6.98E-02	5.83E-02	4.95E-02	4.35E-02	4.07E-02	3.97E-02	3.90E-02	0.	0.
298155	1.17E-02	1.03E-02	9.68E-03	8.86E-03	8.22E-03	7.99E-03	7.80E-03	7.71E-03	0.	0.
340000	2.59E-02	2.72E-02	2.62E-02	2.50E-02	2.39E-02	2.34E-02	2.32E-02	2.30E-02	0.	0.
400000	2.80E-02	3.66E-02	3.78E-02	3.82E-02	3.82E-02	3.81E-02	3.81E-02	3.80E-02	0.	0.
420000	3.40E-02	4.76E-02	5.05E-02	5.20E-02	5.27E-02	5.30E-02	5.30E-02	5.31E-02	0.	0.
300000	2.88E-01	2.62E-01	2.40E-01	2.21E-01	2.05E-01	1.97E-01	1.95E-01	1.93E-01	0.	0.
380000	3.24E-02	3.93E-02	3.97E-02	3.94E-02	3.88E-02	3.84E-02	3.82E-02	3.81E-02	0.	0.
430000	6.77E-02	9.85E-02	1.06E-01	1.10E-01	1.12E-01	1.13E-01	1.13E-01	1.14E-01	0.	0.
500000	6.02E-02	1.28E-01	1.49E-01	1.64E-01	1.78E-01	1.84E-01	1.84E-01	1.87E-01	0.	0.
520000	6.27E-02	1.66E-01	1.99E-01	2.25E-01	2.45E-01	2.55E-01	2.59E-01	2.61E-01	0.	0.

TABLE 67. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C 5+

STATE	LEVEL		STAT.	TEMPERATURE (DEG K)											
	(CM-1)	(EVI)		1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400
1s	0	0.	2	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
2s	2963904	367.4678	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p	2964195	367.5039	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3s	3512929	435.5244	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3p	3513015	435.5471	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3d	3513090	435.5544	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4s	3705071	459.3584	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4p	3705107	459.3629	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4d	3705138	459.3667	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4f	3705151	459.3683	14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL	TEMPERATURE (DEG K)											
	8000	9200	9600	10000	11000	12000	13000	14000	15000	16000	17000	18000
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
2963904	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2964195	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3512929	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3513015	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3513090	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3705071	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3705107	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3705138	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3705151	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
 NONSTARRED ENERGY LEVELS FROM GARCIA AND MACK (1965)

TABLE 57 (CONT.-1). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF C 5+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	10000	20000	24000	28000	32000	36000	40000	44000	48000	50000
0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
2963904	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2964195	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3512929	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3513015	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3513090	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3705071	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3705107	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3705138	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3705151	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	10000	20000	24000	28000	32000	36000	40000	44000	48000	50000
0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
2963904	5.49E-10	2.34E-05	8.13E-04	1.18E-02	3.59E-02	3.77E-02	7.45E-02	5.43E-02	0.	0.
2964195	1.64E-09	7.02E-05	2.44E-03	3.54E-02	1.08E-01	1.13E-01	1.10E-01	1.04E-01	0.	0.
3512929	1.06E-11	3.25E-06	2.18E-04	5.16E-03	2.42E-02	3.09E-02	3.21E-02	3.27E-02	0.	0.
3513015	3.17E-11	9.75E-06	6.54E-04	1.61E-02	7.25E-02	9.28E-02	9.63E-02	9.82E-02	0.	0.
3513090	5.29E-11	1.63E-05	1.09E-03	2.68E-02	1.21E-01	1.55E-01	1.60E-01	1.64E-01	0.	0.
3705071	2.64E-12	1.32E-06	1.37E-04	4.06E-03	2.10E-02	2.80E-02	3.26E-02	3.82E-02	0.	0.
3705107	7.97E-12	4.80E-06	4.12E-04	1.22E-02	6.31E-02	8.66E-02	9.19E-02	9.58E-02	0.	0.
3705138	1.33E-11	8.15E-06	6.87E-04	2.03E-02	1.05E-01	1.44E-01	1.53E-01	1.59E-01	0.	0.
3705151	1.86E-11	1.14E-05	9.62E-04	2.84E-02	1.57E-01	2.02E-01	2.15E-01	2.23E-01	0.	0.

TABLE 48. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N 5+

STATE	LEVEL		STAT.	TEMPERATURE (DEC K)											
	(CM-1)	(EV)		WT.	5200	5600	6000	6400	6800	7200	7600	8000	8400		
1s	0	0.	1	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00		
1s 1s	33858900	419.7843	3	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
1s 2s	34480000	426.4946	1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
1s 2p	3447308	427.4007	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
1s 3s	39900000	494.8842	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
1s 3p	40000000	496.9158	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
1s 3d	48110000	497.5358	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
1s 4s	42000000	520.7202	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
1s 4p	42020000	520.9682	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
1s 4d	42030000	521.0921	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
1s 4f	42030000	521.0921	28	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		

LEVEL	TEMPERATURE (DEC K)												
	(CM-1)	8000	9200	9600	10000	11000	12000	13000	14000	15000	16000	17000	18000
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
3385890	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3448000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3447308	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3990000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4000000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4811000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4200000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4202000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4203000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4203000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
MONITORING ENERGY LEVELS FROM MOORE (1949) AND EOLEN (1952)

TABLE 408 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N 5+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	19000	20000	24000	28000	32000	36000	40000	44000	48000	100000
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
3385870	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.00E 00
3440000	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.07E-26
3447308	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.35E-27
3990000	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.50E-36
4708200	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.42E-26
4708300	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.45E-21
4708400	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.74E-31
4708500	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.94E-31
4708600	0.	0.	0.	0.	0.	0.	0.	0.	0.	9.09E-31
4708700	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.68E-24
4708800	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.27E-33
4708900	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.28E-26
4709000	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.81E-32
4709100	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.65E-26
4709200	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.97E-32
4709300	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.09E-25
4709400	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.16E-32
4709500	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.53E-25

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	1000000	2000000	4000000	6000000	10000000	0	0
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	0.	0.
3385870	7.92E-11	1.54E-05	8.85E-04	1.67E-02	3.51E-02	3.14E-02	2.95E-02	2.80E-02	0.	0.
3440000	1.79E-11	4.23E-06	2.49E-04	5.14E-03	1.13E-02	1.03E-02	9.71E-03	9.24E-03	0.	0.
3447308	2.04E-10	4.94E-05	3.04E-03	6.11E-02	1.34E-01	1.23E-01	1.16E-01	1.11E-01	0.	0.
3990000	1.37E-12	2.34E-06	2.77E-04	9.12E-03	3.03E-02	3.37E-02	3.48E-02	3.42E-02	0.	0.
4008000	1.61E-12	6.58E-06	7.96E-04	2.73E-02	8.98E-02	1.00E-01	1.02E-01	1.02E-01	0.	0.
4013000	5.80E-12	1.98E-05	1.31E-03	4.51E-02	1.49E-01	1.07E-01	1.09E-01	1.70E-01	0.	0.
4200200	3.02E-13	1.10E-06	1.68E-04	6.89E-03	2.61E-02	3.12E-02	3.24E-02	3.31E-02	0.	0.
4202000	8.93E-13	3.27E-06	5.00E-04	2.06E-02	7.81E-02	9.36E-02	9.70E-02	9.94E-02	0.	0.
4203000	1.48E-12	5.44E-06	8.31E-04	3.43E-02	1.30E-01	1.56E-01	1.63E-01	1.64E-01	0.	0.
4203000	2.07E-12	7.61E-06	1.16E-03	4.80E-02	1.82E-01	2.18E-01	2.26E-01	2.32E-01	0.	0.

TABLE 69. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O 5+

STATE	LEVEL		STAT.	TEMPERATURE (DEG K)									
	(CM-1)	(EV)		WT.	5200	5600	6000	6400	6800	7200	7600	8000	8400
1s 2s	0	0.	2	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
2p 3s	96730	11.9927	6	7.14E-12	4.83E-11	2.53E-10	1.08E-09	3.88E-09	1.21E-08	3.34E-08	8.35E-08	1.91E-07	4.30E-06
3p 3s	640040	76.3528	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3p 3p	646218	82.5984	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3d 3d	676656	83.6445	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4s	852694	105.7181	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4p 3p	863376	107.0422	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4d 3d	866893	107.4783	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4f 3p	867083	107.5018	14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL	TEMPERATURE (DEG K)									
	8800	9200	9600	10000	11000	12000	13000	14000	15000	16000
0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
96730	4.06E-07	8.08E-07	1.52E-06	2.71E-06	9.60E-06	2.74E-05	6.72E-05	1.64E-04	2.80E-04	5.09E-04
640040	0.	0.	0.	0.	4.39E-17	4.70E-16	1.72E-15	2.71E-15	2.18E-15	1.01E-15
646218	0.	0.	0.	0.	4.29E-18	6.11E-17	2.85E-16	5.52E-16	5.30E-16	2.80E-16
676656	0.	0.	0.	0.	0.	3.70E-15	1.87E-14	3.93E-14	3.93E-14	2.24E-14
852694	0.	0.	0.	0.	0.	0.	0.	8.75E-19	3.01E-18	5.00E-18
863376	0.	0.	0.	0.	0.	0.	0.	0.	3.24E-18	5.74E-18
866893	0.	0.	0.	0.	0.	0.	0.	0.	3.84E-18	6.97E-18
867083	0.	0.	0.	0.	0.	0.	0.	0.	5.31E-18	9.40E-18

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTANDARD ENERGY LEVELS FROM MOORE (1949)

TABLE 69 (CONT.) 1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O 5+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	19000	20000	24000	28000	32000	36000	40000	44000	48000	50000
0	9.98E-01	9.97E-01	9.91E-01	9.80E-01	9.63E-01	9.41E-01	9.15E-01	8.87E-01	8.58E-01	8.28E-01
96730	1.97E-03	2.84E-03	9.01E-03	2.74E-02	3.73E-02	5.91E-02	8.47E-02	1.13E-01	1.42E-01	1.72E-01
640040	8.91E-22	1.00E-20	2.15E-17	5.10E-15	3.06E-13	7.32E-12	9.19E-11	7.22E-10	4.00E-09	1.67E-07
666218	3.68E-22	4.58E-21	1.34E-17	3.79E-15	2.83E-13	7.71E-12	1.07E-10	9.21E-10	5.47E-09	2.07E-07
674656	3.24E-22	4.16E-21	1.35E-17	4.31E-15	3.23E-13	9.17E-12	1.32E-10	1.16E-09	7.08E-09	3.64E-07
852496	9.04E-29	2.28E-27	6.24E-23	9.14E-20	2.15E-17	1.49E-15	4.30E-14	6.90E-13	1.02E-12	1.02E-09
863376	1.21E-28	3.17E-27	9.87E-23	1.59E-19	4.00E-17	2.92E-15	8.94E-14	1.46E-12	1.40E-11	2.36E-09
866893	1.54E-28	4.11E-27	1.35E-22	2.31E-19	5.69E-17	4.22E-15	1.31E-13	2.17E-12	2.23E-11	3.62E-09
867083	2.13E-28	5.67E-27	1.84E-22	3.74E-19	7.89E-17	5.87E-15	1.83E-13	3.02E-12	3.10E-11	5.04E-09

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	800000	1000000	2000000	4000000	6000000	10000000	0
0	3.84E-01	2.15E-01	1.39E-01	8.58E-02	5.57E-02	4.41E-02	4.04E-02	3.81E-02	0.	0.
96730	5.75E-01	4.54E-01	3.30E-01	2.74E-01	1.56E-01	1.28E-01	1.19E-01	1.13E-01	0.	0.
640040	3.85E-03	2.15E-02	2.99E-02	3.42E-02	3.52E-02	3.50E-02	3.49E-02	3.47E-02	0.	0.
666218	9.58E-03	5.80E-02	8.43E-02	9.87E-02	1.03E-01	1.04E-01	1.04E-01	1.04E-01	0.	0.
674656	1.50E-02	9.51E-02	1.38E-01	1.62E-01	1.71E-01	1.73E-01	1.73E-01	1.73E-01	0.	0.
852496	8.33E-04	1.00E-02	1.60E-02	2.51E-02	3.02E-02	3.24E-02	3.31E-02	3.37E-02	0.	0.
863376	2.31E-03	2.89E-02	5.25E-02	7.43E-02	9.99E-02	9.69E-02	9.91E-02	1.01E-01	0.	0.
866893	3.74E-03	4.76E-02	8.68E-02	1.23E-01	1.49E-01	1.61E-01	1.65E-01	1.68E-01	0.	0.
867083	5.26E-03	6.66E-02	1.22E-01	1.72E-01	2.09E-01	2.26E-01	2.31E-01	2.35E-01	0.	0.



TABLE 70. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 5+

STATE	LEVEL	STAT.	WT.	TEMPERATURE (DEG K)									
				5200	5400	6000	6400	6800	7200	7600	8000	8400	
3 <sup>2</sup> 3p	1470	6	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	
	218631	19	1.14E-28	9.79E-25	4.04E-23	1.03E-21	1.83E-20	2.37E-19	2.53E-18	1.82E-17	1.17E-16		
	101284	12	2.93E-12	1.46E-11	8.06E-11	3.60E-10	1.33E-09	4.33E-09	1.24E-08	3.20E-08	7.32E-08		
	132530	10	2.93E-18	3.98E-15	3.74E-14	2.87E-13	1.51E-12	7.94E-12	2.79E-11	9.44E-11	2.77E-10		
	183112	6	1.49E-22	5.40E-21	1.21E-19	1.84E-18	2.04E-17	1.72E-16	1.16E-15	6.49E-15	2.10E-14		
3 <sup>2</sup> 3d	169801	2	1.97E-21	3.50E-20	9.83E-19	1.22E-17	1.13E-16	8.21E-16	4.82E-15	2.37E-14	1.00E-13		
	315000**	90	3.17E-37	1.56E-34	3.34E-32	3.67E-30	2.32E-28	9.24E-27	2.50E-25	.87E-24	7.13E-23		
	370000**	30	0.	0.	0.	5.22E-36	6.83E-34	9.20E-32	2.51E-30	8.21E-29	1.93E-27		
	270000**	20	1.80E-32	3.63E-30	3.61E-28	2.02E-26	7.04E-25	1.84E-23	2.78E-22	3.54E-21	3.53E-20		
	342246	2	0.	3.12E-39	1.07E-34	1.77E-34	1.60E-32	8.81E-31	3.17E-29	7.99E-28	1.48E-26		
3 <sup>2</sup> 3p	410300*	6	0.	0.	0.	0.	2.88E-38	3.51E-36	2.58E-34	1.23E-32	4.09E-31		
	454780	10	0.	0.	0.	0.	0.	8.93E-38	6.52E-36	4.52E-34	3.16E-34		
	460000*	14	0.	0.	0.	0.	0.	0.	4.66E-38	3.58E-36	1.82E-34		
	469000**	24	0.	0.	0.	0.	0.	0.	0.	1.21E-34	6.44E-33		
	540000*	72	0.	0.	0.	0.	0.	0.	0.	0.	0.		
3 <sup>2</sup> 3d	580000*	120	0.	0.	0.	0.	0.	0.	0.	0.	0.		
	590000*	168	0.	0.	0.	0.	0.	0.	0.	0.	0.		
	600000*	150	0.	0.	0.	0.	0.	0.	0.	0.	0.		
	620000*	30	0.	0.	0.	0.	0.	0.	0.	0.	0.		
	630000*	90	0.	0.	0.	0.	0.	0.	0.	0.	0.		
3 <sup>2</sup> 3p	670000*	150	0.	0.	0.	0.	0.	0.	0.	0.	0.		
	710000*	710	0.	0.	0.	0.	0.	0.	0.	0.	0.		
	730000*	710	0.	0.	0.	0.	0.	0.	0.	0.	0.		

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949) AND FANCETT ET AL. (1961)

TABLE 70 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ar 5+

LEVEL	TEMPERATURE (DEG K)												
	(CM-1)	8800	9200	9600	10000	11000	12000	13000	14000	15000	16000	17000	18000
1470	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	9.99E-01
210631	6.34E-16	2.97E-15	1.22E-14	4.49E-14	7.69E-13	8.20E-12	6.08E-11	3.38E-10	1.50E-09	5.51E-09	1.74E-08	4.02E-08	6.85E-08
101294	1.64E-07	3.32E-07	6.37E-07	1.16E-06	4.28E-06	1.27E-05	3.19E-05	7.01E-05	1.39E-04	2.53E-04	4.29E-04	6.85E-04	1.07E-03
137536	8.24E-10	2.09E-09	4.91E-09	1.08E-08	5.98E-08	2.50E-07	8.36E-07	2.36E-06	5.78E-06	1.27E-05	2.54E-05	4.70E-05	7.40E-05
183112	1.27E-13	4.60E-13	1.50E-12	4.47E-12	4.81E-11	3.48E-10	1.86E-09	7.81E-09	2.71E-08	8.04E-08	2.11E-07	4.94E-07	8.94E-07
169801	3.72E-13	1.23E-12	3.68E-12	1.01E-11	9.14E-11	5.72E-10	2.70E-09	1.02E-08	3.24E-08	8.89E-08	2.14E-07	4.78E-07	7.78E-07
315000	8.19E-21	7.61E-21	5.87E-20	3.35E-19	2.32E-17	7.08E-16	1.28E-14	1.32E-13	1.30E-12	8.54E-12	4.48E-11	1.94E-10	8.64E-10
170000	3.40E-26	6.64E-25	5.15E-24	4.89E-23	5.81E-21	3.23E-18	9.64E-16	1.76E-14	2.27E-13	2.02E-12	1.42E-11	8.04E-11	1.26E-10
270000	2.85E-18	1.93E-18	1.11E-17	5.54E-17	1.86E-15	3.67E-14	4.13E-13	3.65E-12	2.17E-11	1.09E-10	4.99E-10	1.59E-09	4.91E-09
342236	2.10E-23	2.37E-24	2.18E-23	1.69E-22	1.45E-20	5.97E-19	1.38E-17	2.05E-16	2.12E-15	1.63E-14	5.90E-14	4.91E-13	7.78E-13
410000	9.81E-30	1.79E-28	2.56E-27	2.97E-26	6.21E-24	5.34E-22	2.31E-20	5.84E-19	9.59E-18	1.11E-16	9.63E-16	6.57E-15	1.07E-14
454700	1.08E-32	2.71E-31	5.19E-30	7.47E-29	2.96E-26	4.14E-24	2.71E-22	9.75E-21	2.18E-19	3.30E-18	3.62E-17	3.05E-16	2.52E-15
460000	6.45E-33	1.68E-31	5.33E-30	5.20E-29	2.09E-26	3.10E-24	2.13E-22	7.99E-21	1.88E-19	2.89E-18	3.26E-17	2.82E-16	2.42E-15
469000	2.54E-33	7.04E-32	1.48E-30	2.44E-29	1.11E-26	1.81E-24	1.35E-22	5.43E-21	1.34E-19	2.20E-18	2.61E-17	2.35E-16	2.07E-15
540000	0.	5.18E-36	1.06E-34	2.68E-33	3.07E-30	1.09E-27	1.56E-25	1.10E-23	4.42E-22	1.12E-20	1.93E-19	2.42E-18	3.94E-17
590000	0.	0.	4.41E-37	1.42E-35	2.74E-32	1.50E-29	3.11E-27	3.02E-25	1.59E-23	5.10E-22	1.09E-20	1.65E-19	2.52E-18
600000	0.	0.	0.	1.12E-36	2.80E-33	1.91E-30	4.77E-28	5.41E-26	3.27E-24	1.18E-22	2.80E-21	4.67E-20	7.40E-19
420000	4.78E-29	9.37E-28	1.43E-26	4.20E-25	4.20E-23	4.02E-21	1.91E-19	5.22E-18	9.18E-17	1.13E-15	1.03E-14	7.39E-14	1.19E-13
600000	0.	0.	0.	1.99E-37	5.00E-34	3.41E-31	8.51E-29	9.64E-27	5.89E-25	2.11E-23	5.00E-22	8.34E-21	1.26E-20
670000	0.	0.	0.	0.	1.58E-37	2.32E-34	1.10E-31	2.18E-29	2.12E-27	1.17E-25	4.01E-24	9.29E-23	1.59E-22
710000	0.	0.	0.	0.	0.	3.19E-36	2.20E-33	5.95E-31	7.43E-29	5.34E-27	2.26E-25	6.33E-24	1.07E-23
730000	0.	0.	0.	0.	0.	4.06E-37	3.36E-34	1.07E-31	1.57E-29	1.24E-27	5.83E-26	1.79E-24	2.94E-23

TABLE 70 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 5+

LEVEL	TEMPERATURE (DEG K)									
	19000	20000	24000	28000	32000	36000	40000	44000	48000	50000
(CM-1)										
1470	9.99E-01	9.98E-01	9.94E-01	9.96E-01	9.73E-01	9.55E-01	9.32E-01	9.04E-01	8.74E-01	7.70E-01
218631	1.20E-07	2.73E-07	1.68E-06	2.14E-05	9.32E-05	2.71E-04	6.29E-04	1.24E-03	2.17E-03	7.03E-03
101244	1.04E-03	1.52E-03	5.01E-03	1.17E-02	2.15E-02	3.54E-02	5.14E-02	6.92E-02	8.77E-02	1.41E-01
132530	4.15E-05	1.34E-04	6.41E-04	1.35E-03	4.44E-03	8.44E-03	1.39E-02	2.07E-02	2.84E-02	5.34E-02
183112	1.06E-06	2.11E-06	1.85E-05	9.72E-05	2.76E-04	6.72E-04	1.39E-03	2.38E-03	3.77E-03	9.69E-03
169801	9.69E-07	1.84E-06	1.37E-05	5.76E-05	1.68E-04	3.81E-04	7.29E-04	1.23E-03	1.87E-03	4.13E-03
319000	7.32E-10	2.40E-09	1.02E-07	1.69E-06	1.10E-05	5.18E-05	1.77E-04	4.78E-04	1.04E-03	3.17E-02
319000	3.79E-12	1.53E-11	1.26E-09	2.34E-08	3.10E-07	1.32E-06	6.19E-06	2.64E-05	6.94E-05	5.94E-04
270000	4.91E-09	1.36E-08	3.38E-07	1.34E-06	1.85E-05	6.95E-05	1.98E-04	4.53E-04	9.30E-04	4.10E-03
347286	2.06E-12	7.48E-12	4.44E-10	8.15E-09	7.18E-08	3.87E-07	1.67E-06	4.34E-06	1.07E-05	7.25E-05
410000	3.66E-14	1.72E-13	2.30E-11	7.53E-10	1.03E-08	7.74E-08	1.87E-07	1.43E-06	4.20E-06	4.29E-05
444740	2.08E-15	1.14E-14	2.61E-12	1.26E-10	2.20E-09	2.15E-08	1.29E-07	5.50E-07	1.83E-06	2.44E-05
460000	1.94E-15	1.19E-14	2.67E-12	1.19E-10	2.53E-09	2.45E-08	1.49E-07	6.96E-07	2.19E-06	3.02E-05
460000	1.68E-15	9.87E-15	2.67E-12	1.45E-10	2.89E-09	2.93E-08	1.85E-07	7.29E-07	2.87E-06	4.17E-05
540000	2.33E-17	1.79E-16	1.14E-13	1.14E-11	3.56E-10	5.15E-09	4.32E-08	2.44E-07	1.02E-06	2.28E-05
540000	1.88E-18	1.68E-17	1.72E-14	2.42E-12	9.82E-11	1.73E-09	1.71E-08	1.10E-07	5.14E-07	1.15E-05
600000	5.79E-19	5.58E-18	7.27E-15	1.21E-12	5.60E-11	1.09E-09	1.17E-08	6.01E-08	3.95E-07	1.26E-05
420000	4.30E-13	2.09E-12	3.15E-10	1.15E-08	1.64E-07	1.30E-06	6.75E-06	2.57E-05	7.78E-05	8.43E-04
600000	1.03E-19	9.94E-19	1.30E-15	2.17E-13	9.99E-12	1.95E-10	2.08E-09	1.53E-08	7.04E-08	2.25E-06
670000	1.55E-21	1.94E-20	3.86E-17	1.78E-14	1.29E-12	3.57E-11	5.03E-10	4.35E-09	2.60E-08	1.26E-06
710000	1.25E-22	1.82E-21	8.88E-18	3.50E-15	3.55E-13	1.20E-11	1.94E-10	1.94E-09	1.31E-08	8.05E-07
730000	3.8E-23	6.05E-22	3.74E-18	1.90E-15	2.02E-13	7.56E-12	1.34E-10	1.43E-09	1.00E-08	6.98E-07

TABLE 70 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 5+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	1000000	2000000	4000000	6000000	10000000	0	0
1470	1.13E-01	2.97E-02	1.70E-02	1.04E-02	7.22E-03	5.94E-03	5.56E-03	5.27E-03	0.	0.
216331	3.94E-02	2.27E-02	1.69E-02	1.07E-02	7.03E-03	5.15E-03	4.80E-03	4.52E-03	0.	0.
101284	1.11E-01	4.19E-02	2.88E-02	1.93E-02	1.34E-02	1.13E-02	1.09E-02	1.04E-02	0.	0.
137930	7.36E-02	3.09E-02	2.07E-02	1.45E-02	1.09E-02	9.47E-03	8.98E-03	8.52E-03	0.	0.
183112	3.07E-02	1.55E-02	1.10E-02	8.11E-03	6.33E-03	5.56E-03	5.32E-03	5.14E-03	0.	0.
169801	1.13E-02	5.40E-03	3.79E-03	2.76E-03	2.13E-03	1.86E-03	1.78E-03	1.72E-03	0.	0.
315000	1.79E-01	1.44E-01	1.20E-01	1.01E-01	8.64E-02	7.96E-02	7.74E-02	7.56E-02	0.	0.
370000	4.00E-02	3.94E-02	3.52E-02	3.10E-02	2.77E-02	2.60E-02	2.55E-02	2.50E-02	0.	0.
270000	5.49E-02	3.77E-02	2.94E-02	2.39E-02	1.98E-02	1.80E-02	1.74E-02	1.69E-02	0.	0.
342286	3.26E-03	2.91E-03	2.51E-03	2.15E-03	1.88E-03	1.75E-03	1.71E-03	1.67E-03	0.	0.
410000	6.09E-03	6.83E-03	6.39E-03	5.84E-03	5.38E-03	5.13E-03	5.04E-03	4.97E-03	0.	0.
454790	7.25E-03	9.69E-03	9.57E-03	9.15E-03	8.68E-03	8.41E-03	8.31E-03	8.24E-03	0.	0.
460000	9.77E-03	1.33E-02	1.32E-02	1.21E-02	1.21E-02	1.17E-02	1.16E-02	1.15E-02	0.	0.
449000	1.57E-02	2.21E-02	2.22E-02	2.15E-02	2.06E-02	2.01E-02	1.99E-02	1.97E-02	0.	0.
540000	2.83E-02	5.14E-02	5.62E-02	5.81E-02	5.88E-02	5.87E-02	5.86E-02	5.86E-02	0.	0.
560000	3.53E-02	7.41E-02	8.51E-02	9.17E-02	9.52E-02	9.65E-02	9.68E-02	9.71E-02	0.	0.
600000	4.28E-02	9.64E-02	1.14E-01	1.29E-01	1.31E-01	1.34E-01	1.35E-01	1.35E-01	0.	0.
620000	1.40E-01	1.65E-01	1.56E-01	1.44E-01	1.33E-01	1.28E-01	1.26E-01	1.24E-01	0.	0.
600400	7.65E-03	1.73E-02	2.03E-02	2.23E-02	2.35E-02	2.39E-02	2.41E-02	2.42E-02	0.	0.
670000	1.39E-02	4.02E-02	5.14E-02	6.04E-02	6.69E-02	7.00E-02	7.11E-02	7.19E-02	0.	0.
710000	1.73E-02	5.31E-02	7.79E-02	9.51E-02	1.08E-01	1.15E-01	1.17E-01	1.19E-01	0.	0.
730000	2.10E-02	7.57E-02	1.04E-01	1.29E-01	1.50E-01	1.60E-01	1.63E-01	1.64E-01	0.	0.

TABLE 71. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF R 6+

STATE	LEVEL		STAT.	TEMPERATURE (DEG K)											
	(CM-1)	(EV)		5200	5600	6000	6400	6800	7200	7600	8000	8400	8800	9200	9600
1s	0	0.	2	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
2s	4034806	500.2393	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p	4035348	500.3065	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3s	4782276	592.9114	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3p	4782437	592.9313	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3d	4782575	592.9484	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4s	5043859	625.3427	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4p	5043926	625.3510	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4d	5043985	625.3583	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4f	5044010	625.3614	14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL	TEMPERATURE (DEG K)											
	(CM-1)	8800	9200	9600	10000	11000	12000	13000	14000	15000	16000	17000
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
4034806	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4035348	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4782276	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4782437	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4782575	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5043859	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5043926	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5043985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5044010	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
 NONSTANDARD ENERGY LEVELS FROM GARCIA AND MACK (1965)

TABLE 71 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF N 6+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	10000	20000	24000	28000	32000	36000	40000	44000	48000	100000
0	1.00E 00	1.00E 00	1.00E 00	1.30E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
4034806	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4035348	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4782276	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4782437	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4782575	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5043859	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5043926	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5043985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5044010	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	1000000	2000000	4000000	6000000	10000000	0	0
0	1.00E 00	1.00E 00	1.00E 00	9.68E-01	5.17E-01	1.62E-01	9.85E-02	6.44E-02	0.	0.
4034806	2.40E-13	4.90E-07	6.28E-05	2.92E-03	2.84E-02	3.81E-02	3.74E-02	3.61E-02	0.	0.
4035348	7.40E-13	1.49E-06	1.88E-04	9.74E-03	8.52E-02	1.14E-01	1.12E-01	1.08E-01	0.	0.
4782276	1.14E-15	3.30E-08	1.05E-05	9.95E-04	1.66E-02	2.91E-02	3.13E-02	3.24E-02	0.	0.
4782437	3.43E-15	1.01E-07	3.14E-05	2.98E-03	4.97E-02	8.73E-02	9.39E-02	9.72E-02	0.	0.
4782575	5.71E-15	1.69E-07	5.22E-05	4.97E-03	8.29E-02	1.45E-01	1.56E-01	1.62E-01	0.	0.
5043859	1.74E-14	1.32E-08	5.58E-04	6.61E-04	1.31E-02	2.65E-02	2.94E-02	3.12E-02	0.	0.
5043926	5.21E-16	3.90E-08	1.68E-15	2.05E-03	4.12E-02	7.94E-02	8.82E-02	9.36E-02	0.	0.
5043985	8.71E-16	6.60E-08	2.79E-05	3.41E-03	6.87E-02	1.32E-01	1.47E-01	1.56E-01	0.	0.
5044010	1.22E-15	9.24E-08	3.91E-05	4.78E-03	9.62E-02	1.85E-01	2.04E-01	2.19E-01	0.	0.

TABLE 1. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O 6+

STATE	LEVEL (CM-1)	LEVEL (eV)	STAT. WT.	TEMPERATURE (DEG K)									
				5200	5400	5600	6000	6400	6800	7200	7600	8000	8400
1s 1S	0	0.	1	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
1s 2s	4525270	541.0475	3	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1s 2s 1S	4590000*	549.0728	1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1s 2p	4597259	549.9728	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1s 3s	5340000*	662.0585	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1s 3p	4359343	540.4782	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1s 3d	5365010	665.1593	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1s 4s	5620000*	696.7732	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1s 4p	5623000*	697.1452	12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1s 4d	5624000*	697.2691	20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1s 4f	5624000*	697.2691	28	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	8800	9200	9600	10000	11000	12000	13000	14000	15000	16000
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
4525270	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4590000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4597259	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5340000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4359343	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5365010	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5620000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5623000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5624000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5624000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
UNSTARRED ENERGY LEVELS FROM MOORE (1949) AND EDLEN (1952)

TABLE 72 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O 6+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	19000	20000	24000	28000	32000	36000	40000	44000	48000	100000
0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
4525270	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.35E-35
4530000	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.41E-36
4597259	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.08E-29
5340000	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.40E-35
4359363	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.72E-33
5365010	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.07E-33
5620000	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.99E-33
5623000	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.05E-35
5624000	0.	0.	0.	0.	0.	0.	0.	0.	0.	8.78E-35
5624000	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.44E-34
5624000	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.02E-34

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	1000000	2000000	4000000	6000000	10000000	0	0
0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	0	0
4525270	2.18E-14	2.54E-07	5.81E-05	4.15E-03	3.09E-02	3.18E-02	3.00E-02	2.83E-02	0.	0.
4530000	4.57E-15	6.74E-08	1.64E-05	1.24E-03	9.84E-03	1.04E-02	9.84E-03	9.35E-03	0.	0.
4597259	5.20E-14	7.90E-07	1.95E-04	1.50E-02	1.17E-01	1.24E-01	1.18E-01	1.12E-01	0.	0.
5340000	8.29E-17	1.82E-08	1.10E-05	1.71E-03	2.25E-02	3.16E-02	3.25E-02	3.56E-02	0.	0.
4359363	2.84E-13	1.86E-06	3.46E-04	2.11E-02	1.39E-01	1.35E-01	1.25E-01	1.16E-01	0.	0.
5365010	3.46E-16	8.32E-08	5.17E-05	8.27E-03	1.13E-01	1.57E-01	1.63E-01	1.67E-01	0.	0.
5620000	1.11E-17	6.65E-09	5.61E-06	1.15E-03	1.08E-02	2.66E-02	3.07E-02	3.22E-02	0.	0.
5623000	3.25E-17	1.97E-08	1.67E-05	3.42E-03	5.62E-02	6.57E-02	9.22E-02	9.67E-02	0.	0.
5624000	5.37E-17	3.28E-08	2.78E-05	5.69E-03	9.35E-02	1.43E-01	1.54E-01	1.61E-01	0.	0.
5624000	7.52E-17	4.59E-08	3.80E-05	7.97E-03	1.31E-01	2.00E-01	2.15E-01	2.26E-01	0.	0.



TABLE 73. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ar 4+

STATE	LEVEL	STAT.	TEMPERATURE (DEG K)									
			(CM-1)	(EV)	WT.	5200	5600	6000	6400	6800	7200	7600
2s <sup>2</sup> 3s <sup>1</sup>	0	1	114744	0.	1	1.70E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
2s <sup>2</sup> 3p <sup>1</sup>	1	9	14.2261	1.47E-13	1	1.47E-13	1.42E-12	1.01E-11	5.66E-11	2.97E-10	9.91E-10	3.31E-09
2s <sup>2</sup> 3d <sup>1</sup>	2	3	170120	21.1640	3	9.17E-21	2.64E-19	4.99E-18	6.64E-17	1.04E-16	4.50E-15	2.74E-14
3s <sup>2</sup> 3p <sup>1</sup>	3	15	324151	40.1886	15	0.	1.02E-35	2.62E-33	3.37E-31	2.49E-29	1.11E-27	3.39E-26
3s <sup>2</sup> 3d <sup>1</sup>	4	5	2660000	32.9789	5	5.43E-32	1.04E-29	9.93E-28	5.35E-26	1.80E-24	4.11E-23	6.74E-22
3s <sup>2</sup> 3p <sup>1</sup>	5	15	2710000	33.5989	15	4.09E-32	8.64E-30	8.98E-28	5.21E-26	1.80E-24	4.54E-23	7.09E-22
3s <sup>2</sup> 3d <sup>1</sup>	6	45	3100000	18.4361	45	3.34E-34	1.54E-33	5.12E-31	3.25E-29	1.94E-27	7.49E-26	1.95E-24
3s <sup>2</sup> 3p <sup>1</sup>	7	3	3500000	41.3934	3	0.	0.	1.60E-35	3.03E-33	3.10E-31	1.90E-29	7.53E-28
3s <sup>2</sup> 3d <sup>1</sup>	8	15	515383	63.7365	15	0.	0.	0.	0.	0.	0.	0.
3s <sup>2</sup> 3p <sup>1</sup>	9	1	5260000	65.2140	1	0.	0.	0.	0.	0.	0.	0.
3s <sup>2</sup> 3d <sup>1</sup>	10	9	5440000	70.1732	9	0.	0.	0.	0.	0.	0.	0.
3s <sup>2</sup> 3p <sup>1</sup>	11	3	546362	70.2181	3	0.	0.	0.	0.	0.	0.	0.
3s <sup>2</sup> 3d <sup>1</sup>	12	15	636490	78.9127	15	0.	0.	0.	0.	0.	0.	0.
3s <sup>2</sup> 3p <sup>1</sup>	13	5	6380000	79.0999	5	0.	0.	0.	0.	0.	0.	0.
3s <sup>2</sup> 3d <sup>1</sup>	14	21	640092	81.8389	21	0.	0.	0.	0.	0.	0.	0.
3s <sup>2</sup> 3p <sup>1</sup>	15	60	4650000	97.6512	60	0.	0.	0.	0.	0.	0.	0.
3s <sup>2</sup> 3d <sup>1</sup>	16	12	6400000	79.3478	12	0.	0.	0.	0.	0.	0.	0.

TEMPERATURE (DEG K)

LEVEL

(CM-1)	8800	9200	9600	10000	11000	12000	13000	14000	15000	16000	17000	18000
114744	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
14744	6.41E-08	1.49E-07	3.04E-07	6.09E-07	2.73E-06	9.34E-06	2.75E-05	6.81E-05	1.49E-04	2.97E-04	5.45E-04	9.99E-04
170120	2.26E-12	7.62E-12	2.32E-11	6.45E-11	6.02E-10	3.87E-09	1.87E-08	7.20E-08	2.32E-07	4.49E-07	1.59E-06	3.55E-06
324151	1.46E-22	1.49E-21	1.19E-20	8.34E-20	5.79E-18	1.90E-16	3.94E-15	5.11E-14	4.71E-13	3.29E-12	1.82E-11	8.30E-11
2660000	6.47E-19	4.29E-18	2.43E-17	1.20E-16	3.80E-15	7.05E-14	8.19E-13	6.71E-12	4.13E-11	2.04E-10	8.35E-10	2.91E-09
2710000	8.50E-19	5.89E-18	3.44E-17	1.75E-16	6.05E-15	1.14E-14	1.41E-13	1.20E-12	7.71E-11	3.91E-10	1.64E-09	5.84E-09
3100000	5.84E-21	5.29E-20	3.99E-19	2.56E-18	1.47E-16	4.32E-15	7.55E-14	8.79E-13	7.32E-12	4.49E-11	2.42E-10	1.04E-09
3500000	8.32E-24	7.61E-23	7.45E-22	6.07E-21	5.91E-19	2.68E-17	6.74E-16	1.08E-14	1.10E-13	9.45E-13	6.14E-12	3.18E-11
514083	9.41E-37	3.64E-35	1.04E-33	1.26E-32	1.88E-29	5.11E-27	5.05E-25	3.41E-23	1.15E-21	2.51E-20	3.15E-19	4.27E-18
5260000	6.47E-38	1.80E-36	5.79E-35	1.34E-33	1.32E-30	4.08E-28	5.21E-26	3.34E-24	1.23E-22	2.87E-21	4.63E-20	5.49E-19
5660000	0.	0.	1.30E-34	3.87E-33	6.34E-32	3.03E-29	5.11E-27	4.92E-25	2.30E-23	7.09E-22	1.61E-20	2.82E-19
568362	0.	0.	4.10E-37	1.22E-35	2.02E-32	9.46E-30	1.89E-28	1.48E-25	7.44E-23	2.20E-22	4.37E-21	6.54E-20
634490	0.	0.	0.	0.	1.05E-35	1.00E-32	3.82E-30	5.84E-28	7.59E-26	2.80E-24	4.04E-23	1.28E-21
6380000	0.	0.	0.	0.	2.87E-34	3.00E-33	1.04E-30	1.08E-28	1.32E-26	1.77E-24	1.77E-23	3.58E-22
640092	0.	0.	0.	0.	6.89E-37	8.92E-34	3.93E-31	7.25E-29	6.68E-27	3.49E-25	1.15E-23	2.98E-22
4650000	5.76E-32	1.57E-30	3.25E-29	5.28E-28	2.31E-25	3.67E-23	2.64E-21	1.04E-19	2.54E-18	4.15E-17	4.04E-16	4.32E-15
6400000	0.	0.	0.	0.	5.29E-36	5.67E-33	2.07E-30	3.27E-28	2.62E-26	1.22E-24	3.59E-23	7.27E-22

\*ESTIMATED  
NONSTARRED ENERGY LEVELS FROM MOORE (1949)

TABLE 73 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 4+

LEVEL	TEMPERATURE (DEG K)											
	10000	20000	24000	28000	32000	36000	40000	44000	48000	52000	56000	60000
1C4-11	0	0	0	0	0	0	0	0	0	0	0	0
114744	9.28E-01	2.38E-01	9.91E-01	5.75E-01	9.49E-01	9.13E-01	8.67E-01	8.14E-01	7.57E-01	6.95E-01	6.28E-01	5.56E-01
170720	1.51E-03	2.38E-03	9.10E-03	2.41E-02	4.91E-02	6.31E-02	1.24E-01	1.72E-01	2.19E-01	2.34E-01	4.07E-01	3.75E-01
324151	7.28E-06	1.39E-05	1.07E-04	4.53E-04	1.32E-03	2.98E-03	5.60E-03	9.19E-03	1.34E-02	1.94E-02	4.94E-02	5.38E-02
268000	3.27E-10	1.12E-09	1.40E-08	8.54E-07	6.67E-06	3.24E-05	1.12E-04	3.04E-04	6.83E-04	3.70E-03	1.57E-02	3.07E-02
271000	1.92E-09	2.44E-08	5.86E-07	5.65E-06	3.04E-05	1.10E-04	3.03E-04	1.30E-03	4.97E-03	1.49E-02	2.34E-02	2.34E-02
310000	1.83E-08	5.11E-08	1.31E-06	1.31E-05	7.27E-05	2.71E-04	7.59E-04	1.73E-03	3.37E-03	1.32E-02	4.00E-02	6.59E-02
350000	3.82E-09	1.24E-08	3.05E-07	7.07E-06	5.04E-05	2.20E-04	7.47E-04	1.93E-03	2.00E-03	8.10E-03	1.50E-02	1.50E-02
514083	1.39E-10	5.21E-10	3.44E-08	6.79E-07	6.28E-06	3.44E-05	1.33E-04	3.92E-04	9.47E-04	5.94E-03	2.94E-02	8.25E-02
526000	3.71E-17	2.60E-16	1.24E-15	9.25E-12	2.61E-10	1.27E-09	1.27E-08	4.61E-07	7.70E-06	1.03E-04	3.99E-04	3.99E-04
544000	5.02E-18	3.67E-17	2.00E-14	1.74E-12	5.09E-11	6.77E-10	5.24E-09	2.74E-08	1.08E-07	1.95E-06	2.77E-05	1.12E-04
566000	2.16E-18	1.84E-17	1.64E-14	2.05E-12	7.58E-11	1.23E-09	1.12E-08	6.71E-08	2.92E-07	4.72E-06	1.22E-05	5.47E-04
634490	7.09E-19	6.04E-18	5.34E-15	6.72E-13	2.48E-11	4.05E-10	3.49E-09	2.21E-08	9.43E-08	2.22E-06	4.03E-05	1.30E-04
638000	1.75E-20	1.95E-19	3.99E-16	9.14E-14	5.31E-12	1.23E-10	1.40E-09	1.12E-08	5.88E-08	2.04E-06	5.70E-05	3.43E-04
640000	5.20E-21	5.82E-20	1.21E-16	2.82E-14	1.65E-12	3.81E-11	4.48E-10	3.54E-09	1.87E-08	6.64E-07	1.85E-05	1.12E-04
640072	4.10E-21	4.98E-20	1.36E-16	3.91E-14	2.57E-12	6.69E-11	8.88E-10	7.22E-09	4.04E-08	1.64E-06	5.22E-05	3.42E-04
643000	3.05E-14	1.77E-13	4.65E-11	2.44E-09	6.74E-08	4.63E-07	2.83E-06	1.22E-05	4.02E-05	3.09E-04	4.97E-03	1.42E-02
640090	1.07E-20	1.21E-19	2.58E-16	6.11E-14	3.43E-12	8.53E-11	1.05E-09	7.96E-09	4.24E-08	1.52E-06	4.20E-05	2.81E-04

LEVEL	TEMPERATURE (DEG K)											
	100000	200000	300000	400000	500000	600000	700000	800000	900000	1000000	1100000	1200000
1C4-11	0	0	0	0	0	0	0	0	0	0	0	0
114744	4.32E-02	1.39E-02	9.06E-03	4.31E-03	4.74E-03	4.11E-03	3.92E-03	3.74E-03	3.56E-03	3.38E-03	3.20E-03	3.02E-03
170720	1.70E-02	2.24E-02	1.81E-02	1.48E-02	1.24E-02	1.14E-02	1.13E-02	1.12E-02	1.11E-02	1.10E-02	1.09E-02	1.08E-02
324151	6.29E-02	6.50E-02	5.94E-02	5.49E-02	5.04E-02	4.59E-02	4.14E-02	3.69E-02	3.24E-02	2.79E-02	2.34E-02	1.89E-02
268000	3.11E-02	2.67E-02	2.39E-02	2.15E-02	1.91E-02	1.67E-02	1.43E-02	1.19E-02	9.5E-03	7.0E-03	4.5E-03	2.0E-03
271000	9.22E-02	7.87E-02	7.10E-02	6.41E-02	5.87E-02	5.40E-02	5.05E-02	4.69E-02	4.34E-02	3.98E-02	3.62E-02	3.26E-02
310000	2.79E-01	2.74E-01	2.59E-01	2.42E-01	2.28E-01	2.14E-01	2.00E-01	1.86E-01	1.72E-01	1.58E-01	1.44E-01	1.30E-01
350000	1.57E-01	1.78E-01	1.74E-01	1.72E-01	1.64E-01	1.63E-01	1.62E-01	1.61E-01	1.60E-01	1.59E-01	1.58E-01	1.57E-01
514083	3.21E-03	6.54E-03	7.93E-03	9.04E-03	9.84E-03	1.03E-02	1.04E-02	1.05E-02	1.06E-02	1.07E-02	1.08E-02	1.09E-02
526000	9.82E-04	2.10E-03	2.57E-03	2.96E-03	3.26E-03	3.40E-03	3.49E-03	3.58E-03	3.67E-03	3.76E-03	3.85E-03	3.94E-03
566000	6.43E-03	1.63E-02	2.10E-02	2.52E-02	2.83E-02	3.02E-02	3.08E-02	3.12E-02	3.16E-02	3.20E-02	3.24E-02	3.28E-02
566362	2.20E-03	5.44E-03	6.99E-03	8.38E-03	9.49E-03	1.01E-02	1.03E-02	1.04E-02	1.05E-02	1.06E-02	1.07E-02	1.08E-02
634490	6.45E-03	2.11E-02	2.94E-02	3.79E-02	4.51E-02	4.91E-02	5.04E-02	5.15E-02	5.26E-02	5.37E-02	5.48E-02	5.59E-02
638000	2.12E-03	7.01E-03	9.81E-03	1.24E-02	1.50E-02	1.63E-02	1.68E-02	1.72E-02	1.76E-02	1.80E-02	1.84E-02	1.88E-02
640092	7.86E-03	2.72E-02	3.91E-02	5.13E-02	6.21E-02	6.81E-02	7.02E-02	7.19E-02	7.36E-02	7.53E-02	7.70E-02	7.87E-02
643000	9.14E-02	1.57E-01	1.70E-01	1.94E-01	2.04E-01	2.09E-01	2.10E-01	2.11E-01	2.12E-01	2.13E-01	2.14E-01	2.15E-01
640090	5.19E-03	1.67E-02	2.34E-02	3.02E-02	3.60E-02	3.92E-02	4.03E-02	4.14E-02	4.25E-02	4.36E-02	4.47E-02	4.58E-02

TABLE 74. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O 7+

STATE	LEVEL	STAT.	TEMPERATURE (DEG K)													
	(CM-1)	(EV)	WT.	5200	5600	6000	6400	6800	7200	7600	8000	8400				
1s	0	0.	2	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	0.00E 00		
2s	5270855	653.4859	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
2p	5271783	653.6009	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
3s	6247421	774.5415	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
3p	6247696	774.5956	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
3d	6247933	774.6250	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
4s	6589164	816.9311	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
4p	6589279	816.9454	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
4d	6589379	816.9578	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
4f	6589422	816.9631	14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		

LEVEL	TEMPERATURE (DEG K)													
(CM-1)	8800	9200	9600	10000	10400	10800	11200	11600	12000	12400	12800	13200	13600	14000
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
5270855	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5271783	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6247421	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6247696	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6247933	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6589164	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6589279	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6589379	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6589422	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
MONITORING ENERGY LEVELS FROM GAMMA AND X-RAY (1965)

TABLE T4 (CONT.-1). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF O 7+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	10000	20000	24000	28000	32000	36000	40000	44000	48000	50000
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
5270855	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5271783	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6247421	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6247696	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6247933	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6589164	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6589279	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6589379	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6589422	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	1000000	2000000	4000000	6000000	10000000	0	0
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	0	0
5270855	1.41E-17	5.84E-09	3.24E-06	9.94E-01	7.52E-01	2.47E-01	1.34E-01	7.89E-02	0.	0.
5271783	1.02E-16	1.75E-08	9.70E-06	1.52E-03	5.08E-02	3.71E-02	3.80E-02	3.68E-02	0.	0.
6247421	3.03E-20	1.74E-10	3.12E-07	1.74E-04	8.40E-03	2.61E-02	3.01E-02	3.20E-02	0.	0.
6247696	9.07E-20	5.22E-10	9.34E-07	3.73E-04	2.52E-02	7.83E-02	9.82E-02	9.59E-02	0.	0.
6247933	1.51E-19	8.69E-10	1.56E-06	6.21E-04	4.20E-02	1.31E-01	1.50E-01	1.60E-01	0.	0.
6589164	2.59E-21	5.09E-11	1.37E-07	7.60E-05	6.57E-03	2.31E-02	2.77E-02	3.04E-02	0.	0.
6589279	7.77E-21	1.53E-10	4.12E-07	2.28E-04	1.97E-02	6.93E-02	8.31E-02	9.13E-02	0.	0.
6589379	1.29E-20	2.54E-10	6.84E-07	3.80E-04	3.28E-02	1.15E-01	1.34E-01	1.52E-01	0.	0.
6589422	1.81E-20	3.54E-10	9.61E-07	5.32E-04	4.60E-02	1.62E-01	1.94E-01	2.13E-01	0.	0.

TABLE 75. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF CR 7.

STATE	LEVEL	STAT.	(CM-1)	(EV)	WT.	TEMPERATURE (DEG A)									
						5200	5600	6000	6400	6800	7200	7600	8000	8400	8800
2p 3s	0		141870	0.	2	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
	3p		332667	17.5892	6	2.69E-17	4.44E-16	5.04E-15	6.22E-14	2.78E-13	1.44E-12	6.50E-12	2.49E-11	8.39E-11	0.39E-11
	3d		575910	41.2444	10	0.	3.80E-37	1.13E-34	1.44E-32	1.33E-30	6.73E-29	2.23E-27	5.19E-26	8.97E-25	0.
	4s		628905	71.4019	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	4p		716837	77.9723	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4d	0		697517	86.4789	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	4f		716837	88.8742	14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
LEVEL															
TEMPERATURE (DEG K)															
(CM-1)	8800		9200		9600	10000	11000	12000	13000	14000	15000	16000	17000	18000	19000
	0		1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
	141870		2.53E-10	6.94E-10	1.75E-09	4.09E-09	2.62E-08	1.23E-07	4.55E-07	1.40E-06	3.69E-06	8.64E-06	1.83E-05	3.37E-05	6.00E-05
	332667		1.20E-23	1.27E-22	1.11E-21	8.17E-21	6.33E-20	2.38E-19	5.12E-18	7.10E-17	6.93E-16	5.09E-15	2.74E-14	1.41E-13	6.11E-13
	575910		0.	0.	0.	0.	1.03E-36	1.03E-35	2.00E-34	1.97E-33	1.02E-32	3.23E-31	6.79E-30	1.02E-29	4.42E-28
628905	0.		0.	0.	0.	0.	5.65E-36	5.36E-35	1.77E-34	2.55E-33	1.90E-32	6.24E-31	2.50E-30	4.42E-29	6.13E-28
	0.		0.	0.	0.	0.	0.	2.39E-36	1.49E-35	3.69E-34	4.39E-33	2.87E-32	1.15E-31	3.04E-30	8.13E-29
697517	0.		0.	0.	0.	0.	0.	3.30E-37	2.45E-36	7.09E-35	9.63E-34	7.08E-33	3.14E-32	9.01E-31	2.41E-30
716837	0.		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TABLE 75 (CONT.-). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 7+

LEVEL	19000	20000	24000	28000	32000	36000	40000	44000	48000	60000	80000	100000
(CM-1)	TEMPERATURE (DEG K)											
0	1.00E-00	1.00E-00	9.99E-01	9.78E-01	9.95E-01	9.90E-01	9.82E-01	9.72E-01	9.59E-01	9.08E-01	8.02E-01	6.98E-01
141070	6.48E-05	1.11E-04	6.07E-04	2.04E-03	5.07E-03	1.02E-02	1.79E-02	2.82E-02	4.09E-02	9.07E-02	1.88E-01	2.72E-01
332647	5.73E-11	2.02E-10	1.09E-09	1.88E-07	1.59E-06	8.32E-06	3.12E-05	9.17E-05	2.24E-04	1.58E-03	1.01E-02	2.91E-02
575910	1.15E-19	1.02E-18	1.01E-15	1.40E-13	5.65E-12	9.99E-11	9.90E-10	6.44E-09	3.05E-08	9.13E-07	2.55E-05	1.76E-04
628905	6.22E-21	6.73E-20	1.27E-16	2.76E-14	1.56E-12	3.60E-11	4.41E-10	3.41E-09	1.87E-08	7.68E-07	2.95E-05	2.46E-04
697517	5.75E-23	8.04E-22	3.45E-18	1.36E-15	1.19E-13	3.07E-12	6.24E-11	4.04E-10	3.99E-09	2.47E-07	1.43E-05	1.53E-04
716037	1.04E-23	2.61E-22	1.52E-18	7.03E-16	7.00E-14	2.50E-12	4.36E-11	4.49E-10	3.13E-09	2.18E-07	1.41E-05	1.62E-04
LEVEL	TEMPERATURE (DEG K)											
(CM-1)	TEMPERATURE (DEG K)											
0	3.76E-01	1.74E-01	1.18E-01	7.39E-02	5.74E-02	4.81E-02	4.53E-02	4.31E-02	0.	0.	0.	0.
141070	4.04E-01	3.17E-01	2.31E-01	1.45E-01	1.56E-01	1.37E-01	1.31E-01	1.27E-01	0.	0.	0.	0.
332647	1.77E-01	2.65E-01	2.47E-01	2.26E-01	2.13E-01	2.13E-01	2.09E-01	2.09E-01	0.	0.	0.	0.
575910	5.97E-03	2.21E-02	2.96E-02	3.49E-02	3.79E-02	3.91E-02	3.94E-02	3.97E-02	0.	0.	0.	0.
628905	1.22E-02	5.49E-02	7.82E-02	9.69E-02	1.10E-01	1.15E-01	1.17E-01	1.18E-01	0.	0.	0.	0.
697517	1.24E-02	7.13E-02	1.11E-01	1.46E-01	1.74E-01	1.87E-01	1.91E-01	1.95E-01	0.	0.	0.	0.
716037	1.52E-02	9.34E-02	1.48E-01	1.99E-01	2.40E-01	2.60E-01	2.67E-01	2.72E-01	0.	0.	0.	0.

TABLE 7A. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 0+

STATE	LEVEL (CM-1)	STAT. WT.	LEVEL (EV)	TEMPERATURE (DEG K.)											
				5200	5600	6000	6400	6800	7200	7600	8000	8400			
2s <sup>2</sup> 2p <sup>6</sup>	0	1	0.	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00			
	2039000*	12	252.7973	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	2220000*	36	275.2378	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	2380000*	60	295.0748	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	2710000*	12	335.9885	0.	0.	0.	0.	0.	0.	0.	0.	0.			
2s 2p <sup>5</sup>	0	36	345.9075	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	2790000*	60	352.1060	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	2860000*	84	354.5857	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	2600000*	4	322.3506	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	2780000*	12	344.6672	0.	0.	0.	0.	0.	0.	0.	0.	0.			
2s 2p <sup>4</sup>	0	20	364.5041	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	2840000*	40	405.4179	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	3350000*	12	415.3363	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	3400000*	20	421.5354	0.	0.	0.	0.	0.	0.	0.	0.	0.			
	3470000*	28	424.0150	0.	0.	0.	0.	0.	0.	0.	0.	0.			

STATE	LEVEL (CM-1)	TEMPERATURE (DEG K.)											
		8800	9200	9600	10000	11000	12000	13000	14000	15000	16000	17000	18000
2s 2p <sup>4</sup>	0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
	2039000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	2220000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	2380000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	2710000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2s 2p <sup>3</sup>	0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
	2790000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	2840000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	2860000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	2600000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2s 2p <sup>2</sup>	0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
	2940000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	3270000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	3350000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	3400000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM MOORE (1949)

TABLE 76 (CONT.). ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF Ar 8+

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	19000	20000	24000	28000	32000	36000	40000	44000	48000	100000
0	1.00E-00	1.00E-00	1.00E-00	1.30E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
2039000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2220000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2280000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2710000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2790000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2840000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2860000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2860000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2780000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2940000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3270000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3350000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3400000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3420000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	200000	400000	600000	1000000	2000000	4000000	6000000	10000000	0	0
0	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	0	0
2039000	5.11E-04	5.11E-04	5.11E-04	5.11E-04	5.11E-04	5.11E-04	5.11E-04	5.11E-04	0.	0.
2220000	4.17E-04	4.17E-04	4.17E-04	4.17E-04	4.17E-04	4.17E-04	4.17E-04	4.17E-04	0.	0.
2380000	2.20E-04	2.20E-04	2.20E-04	2.20E-04	2.20E-04	2.20E-04	2.20E-04	2.20E-04	0.	0.
2710000	4.10E-08	4.10E-08	4.10E-08	4.10E-08	4.10E-08	4.10E-08	4.10E-08	4.10E-08	0.	0.
2790000	6.91E-08	6.91E-08	6.91E-08	6.91E-08	6.91E-08	6.91E-08	6.91E-08	6.91E-08	0.	0.
2840000	8.04E-08	8.04E-08	8.04E-08	8.04E-08	8.04E-08	8.04E-08	8.04E-08	8.04E-08	0.	0.
2860000	9.75E-08	9.75E-08	9.75E-08	9.75E-08	9.75E-08	9.75E-08	9.75E-08	9.75E-08	0.	0.
2860000	3.01E-08	3.01E-08	3.01E-08	3.01E-08	3.01E-08	3.01E-08	3.01E-08	3.01E-08	0.	0.
2780000	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	0.	0.
2940000	1.30E-08	1.30E-08	1.30E-08	1.30E-08	1.30E-08	1.30E-08	1.30E-08	1.30E-08	0.	0.
3270000	2.43E-10	2.43E-10	2.43E-10	2.43E-10	2.43E-10	2.43E-10	2.43E-10	2.43E-10	0.	0.
3350000	4.10E-10	4.10E-10	4.10E-10	4.10E-10	4.10E-10	4.10E-10	4.10E-10	4.10E-10	0.	0.
3400000	4.77E-10	4.77E-10	4.77E-10	4.77E-10	4.77E-10	4.77E-10	4.77E-10	4.77E-10	0.	0.
3420000	5.78E-10	5.78E-10	5.78E-10	5.78E-10	5.78E-10	5.78E-10	5.78E-10	5.78E-10	0.	0.



TABLE 77. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 4+

STATE	LEVEL (CM-1)	LEVEL (EV)	STAT.	TEMPERATURE (DEG K)									
				22000	24000	30000	34000	38000	42000	46000	50000	56000	76000
2s 2p <sup>5</sup>	0	0.	4	8.67E-01	8.43E-01	8.26E-01	8.11E-01	7.96E-01	7.88E-01	7.79E-01	7.71E-01	7.63E-01	7.43E-01
2s 2p <sup>5</sup>	18053	2.2382	2	1.33E-01	1.33E-01	1.33E-01	1.33E-01	1.33E-01	1.33E-01	1.33E-01	1.33E-01	1.33E-01	1.33E-01
2s 2p <sup>5</sup>	604300	74.9217	2	2.97E-18	1.27E-15	1.07E-13	3.18E-12	4.62E-11	4.03E-10	2.41E-09	1.06E-08	1.59E-06	1.59E-06
2s 2p <sup>5</sup>	2260000	280.1971	18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2s 2p <sup>5</sup>	2440000	302.5136	54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	2800000	322.3506	90	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	3000000	371.9430	288	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	2330000	288.8757	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	2510000	311.1923	30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	2670000	331.0293	50	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	3100000	394.3411	160	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	2500000	309.9525	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	2700000	334.7487	60	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	2750000	340.9476	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	3200000	396.7592	18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	3400000	371.9430	216	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p 2p <sup>4</sup>	3400000	421.5354	384	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL (CM-1)	90000	150000	300000	500000	800000	1500000	3000000	5000000	8000000	0	0	0	0
0	7.27E-01	7.03E-01	6.73E-01	6.06E-01	2.92E-01	4.60E-02	1.19E-02	6.76E-03	4.90E-03	0.	0.	0.	0.
18053	2.73E-01	2.96E-01	3.08E-01	2.88E-01	1.42E-01	2.24E-02	5.89E-03	3.34E-03	2.44E-03	0.	0.	0.	0.
604300	2.32E-05	1.07E-03	1.85E-02	5.23E-02	4.93E-02	1.29E-02	4.44E-03	2.84E-03	2.20E-03	0.	0.	0.	0.
2260000	6.67E-16	1.22E-09	5.94E-05	4.09E-03	2.26E-02	2.37E-02	1.81E-02	1.56E-02	1.47E-02	0.	0.	0.	0.
2440000	1.13E-16	6.50E-10	7.52E-05	7.31E-03	4.90E-02	5.90E-02	4.97E-02	4.52E-02	4.27E-02	0.	0.	0.	0.
2600000	1.45E-17	2.34E-10	5.81E-05	7.68E-03	6.13E-02	8.55E-02	7.68E-02	7.18E-02	6.91E-02	0.	0.	0.	0.
3000000	7.77E-20	1.61E-11	2.73E-05	7.78E-03	9.55E-02	1.84E-01	2.03E-01	2.08E-01	2.04E-01	0.	0.	0.	0.
2330000	1.21E-16	3.46E-10	2.38E-05	1.86E-03	1.11E-02	1.23E-02	9.71E-03	8.64E-03	8.04E-03	0.	0.	0.	0.
2510000	2.04E-17	1.85E-10	2.98E-05	3.32E-03	2.40E-02	3.11E-02	2.67E-02	2.46E-02	2.34E-02	0.	0.	0.	0.
2670000	2.64E-18	6.63E-11	2.31E-05	3.49E-03	3.00E-02	4.44E-02	4.12E-02	3.92E-02	3.79E-02	0.	0.	0.	0.
3100000	8.73E-21	3.43E-12	9.40E-06	3.24E-03	4.43E-02	9.41E-02	1.07E-01	1.11E-01	1.12E-01	0.	0.	0.	0.
2500000	1.60E-18	1.35E-11	2.09E-06	2.28E-04	1.63E-03	2.09E-03	1.79E-03	1.65E-03	1.54E-03	0.	0.	0.	0.
2700000	1.96E-18	5.97E-11	2.40E-05	3.64E-03	3.41E-02	5.18E-02	4.88E-02	4.64E-02	4.53E-02	0.	0.	0.	0.
2750000	1.47E-19	6.16E-12	3.15E-06	5.54E-04	4.20E-03	4.23E-03	7.94E-03	7.46E-03	7.46E-03	0.	0.	0.	0.
3200000	1.99E-22	1.48E-13	6.54E-07	2.73E-04	4.17E-03	9.62E-03	1.15E-02	1.21E-02	1.24E-02	0.	0.	0.	0.
3000000	5.84E-20	1.21E-11	2.05E-05	5.83E-03	7.18E-02	1.40E-01	1.52E-01	1.54E-01	1.54E-01	0.	0.	0.	0.
3400000	1.73E-22	4.63E-13	5.35E-06	3.28E-03	6.20E-02	1.64E-01	2.23E-01	2.44E-01	2.55E-01	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
 \*NONSTARRED ENERGY LEVELS FROM PRYCE (1964).

TABLE 78. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 10+

STATE	LEVEL	STAT.	TEMPERATURE (DEG K)									
			10000	20000	30000	40000	50000	60000	70000	80000	90000	100000
2s 2p <sup>3</sup>	0	5	7.66E-01	7.33E-01	7.05E-01	6.80E-01	6.58E-01	6.39E-01	6.21E-01	6.04E-01	5.88E-01	5.73E-01
	14457	3	1.79E-01	1.79E-01	2.11E-01	2.21E-01	2.28E-01	2.34E-01	2.37E-01	2.40E-01	2.44E-01	2.48E-01
	18000	1	4.72E-02	5.91E-02	5.93E-02	6.35E-02	6.66E-02	6.89E-02	7.09E-02	7.22E-02	7.35E-02	7.51E-02
	70000	5	7.67E-03	1.52E-02	2.45E-02	3.52E-02	4.55E-02	5.81E-02	6.96E-02	8.08E-02	1.30E-01	1.30E-01
	150000	1	8.41E-06	3.64E-05	1.06E-04	2.38E-04	4.50E-04	7.49E-04	1.14E-03	1.62E-03	5.01E-03	5.01E-03
2s 2p <sup>3</sup>	531000	9	1.14E-15	2.28E-13	1.10E-11	2.13E-10	2.20E-09	1.45E-08	4.85E-08	2.52E-07	1.79E-05	1.79E-05
	700000	3	6.03E-21	6.81E-18	1.11E-15	5.57E-14	1.22E-12	1.40E-11	1.16E-10	6.49E-10	1.85E-07	1.85E-07
TEMPERATURE (DEG K)												
2s 2p <sup>3</sup>	0	5	7.66E-01	7.33E-01	7.05E-01	6.80E-01	6.58E-01	6.39E-01	6.21E-01	6.04E-01	5.88E-01	5.73E-01
	14457	3	1.79E-01	1.79E-01	2.11E-01	2.21E-01	2.28E-01	2.34E-01	2.37E-01	2.40E-01	2.44E-01	2.48E-01
	18000	1	4.72E-02	5.91E-02	5.93E-02	6.35E-02	6.66E-02	6.89E-02	7.09E-02	7.22E-02	7.35E-02	7.51E-02
	70000	5	7.67E-03	1.52E-02	2.45E-02	3.52E-02	4.55E-02	5.81E-02	6.96E-02	8.08E-02	1.30E-01	1.30E-01
	150000	1	8.41E-06	3.64E-05	1.06E-04	2.38E-04	4.50E-04	7.49E-04	1.14E-03	1.62E-03	5.01E-03	5.01E-03
	531000	9	1.14E-15	2.28E-13	1.10E-11	2.13E-10	2.20E-09	1.45E-08	4.85E-08	2.52E-07	1.79E-05	1.79E-05
	700000	3	6.03E-21	6.81E-18	1.11E-15	5.57E-14	1.22E-12	1.40E-11	1.16E-10	6.49E-10	1.85E-07	1.85E-07
	0	5	7.66E-01	7.33E-01	7.05E-01	6.80E-01	6.58E-01	6.39E-01	6.21E-01	6.04E-01	5.88E-01	5.73E-01
	14457	3	1.79E-01	1.79E-01	2.11E-01	2.21E-01	2.28E-01	2.34E-01	2.37E-01	2.40E-01	2.44E-01	2.48E-01
	18000	1	4.72E-02	5.91E-02	5.93E-02	6.35E-02	6.66E-02	6.89E-02	7.09E-02	7.22E-02	7.35E-02	7.51E-02
2s 2p <sup>3</sup>	0	5	7.66E-01	7.33E-01	7.05E-01	6.80E-01	6.58E-01	6.39E-01	6.21E-01	6.04E-01	5.88E-01	5.73E-01
	14457	3	1.79E-01	1.79E-01	2.11E-01	2.21E-01	2.28E-01	2.34E-01	2.37E-01	2.40E-01	2.44E-01	2.48E-01
	18000	1	4.72E-02	5.91E-02	5.93E-02	6.35E-02	6.66E-02	6.89E-02	7.09E-02	7.22E-02	7.35E-02	7.51E-02
	70000	5	7.67E-03	1.52E-02	2.45E-02	3.52E-02	4.55E-02	5.81E-02	6.96E-02	8.08E-02	1.30E-01	1.30E-01
	150000	1	8.41E-06	3.64E-05	1.06E-04	2.38E-04	4.50E-04	7.49E-04	1.14E-03	1.62E-03	5.01E-03	5.01E-03
	531000	9	1.14E-15	2.28E-13	1.10E-11	2.13E-10	2.20E-09	1.45E-08	4.85E-08	2.52E-07	1.79E-05	1.79E-05
	700000	3	6.03E-21	6.81E-18	1.11E-15	5.57E-14	1.22E-12	1.40E-11	1.16E-10	6.49E-10	1.85E-07	1.85E-07
	0	5	7.66E-01	7.33E-01	7.05E-01	6.80E-01	6.58E-01	6.39E-01	6.21E-01	6.04E-01	5.88E-01	5.73E-01
	14457	3	1.79E-01	1.79E-01	2.11E-01	2.21E-01	2.28E-01	2.34E-01	2.37E-01	2.40E-01	2.44E-01	2.48E-01
	18000	1	4.72E-02	5.91E-02	5.93E-02	6.35E-02	6.66E-02	6.89E-02	7.09E-02	7.22E-02	7.35E-02	7.51E-02

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM PRYCE (1964).

TABLE 79. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR II\*

STATE	LEVEL		STAT.	TEMPERATURE (DEG K)									
	(CM-1)	(EV)		WT.	22000	26000	30000	34000	38000	42000	46000	50000	70000
2s <sup>2</sup> 2p <sup>6</sup>	0	0.	4	9.91E-01	9.91E-01	9.91E-01	9.91E-01	9.91E-01	9.91E-01	9.91E-01	9.91E-01	9.91E-01	9.91E-01
	107000*	13.2660	10	2.21E-03	6.66E-03	1.45E-02	2.63E-02	4.4E-02	5.94E-02	6.83E-02	7.54E-02	8.04E-02	7.54E-02
	170000*	21.0768	6	2.22E-05	1.22E-04	4.25E-04	1.10E-03	2.50E-03	4.15E-03	6.72E-03	1.00E-02	1.00E-02	3.44E-02
LEVEL				TEMPERATURE (DEG K)									
(CM-1)	90000	150000	300000	700000	8000	1500000	3000000	5000000	8000000	0	0	0	0
	0	6.45E-01	4.57E-01	3.16E-01	2.1E-01	2.43E-01	2.21E-01	2.10E-01	2.04E-01	2.04E-01	0.	0.	0.
	107000	2.91E-01	4.09E-01	4.74E-01	4.91E-01	4.91E-01	4.91E-01	4.91E-01	4.91E-01	4.91E-01	0.	0.	0.
170000	6.37E-02	1.34E-01	2.10E-01	2.45E-01	2.65E-01	2.81E-01	2.91E-01	2.91E-01	2.91E-01	2.91E-01	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
\*\*\*STARTED ENERGY LEVELS FROM

TABLE 80. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 12+

STATE	LEVEL	STAT.	WT.	TEMPERATURE (DEG K)									
				(CM-1)	(EV)	22000	26000	30000	34070	38000	42000	46000	50000
2s 2p <sup>3</sup> P <sub>0</sub> <sup>3</sup> P <sub>1</sub> <sup>3</sup> P <sub>2</sub> 1D 1S	0		1	2.60E-01	2.30E-01	2.09E-01	1.93E-01	1.80E-01	1.70E-01	1.61E-01	1.54E-01	1.30E-01	
	10000	1.2398	3	4.05E-01	3.97E-01	3.88E-01	3.78E-01	3.70E-01	3.61E-01	3.54E-01	3.46E-01	3.17E-01	
	21000	2.6036	5	3.29E-01	3.60E-01	3.81E-01	3.96E-01	4.06E-01	4.13E-01	4.18E-01	4.21E-01	4.22E-01	
	80000	9.9185	5	6.93E-03	1.37E-02	2.25E-02	3.26E-02	4.35E-02	5.48E-02	6.69E-02	7.70E-02	1.25E-01	
	153000	18.9691	1	1.17E-05	4.84E-05	1.36E-04	2.97E-04	5.49E-04	8.98E-04	1.35E-03	1.89E-03	5.40E-03	
LEVEL	TEMPERATURE (DEG K)												
(CM-1)	90000	150000	300000	500000	800000	1500000	3000000	5000000	8000000	0	0	0	
0	1.14E-01	9.65E-02	8.15E-02	7.55E-02	7.22E-02	6.94E-02	6.81E-02	6.74E-02	6.72E-02	0.	0.	0.	
10000	2.97E-01	2.63E-01	2.33E-01	2.20E-01	2.13E-01	2.07E-01	2.03E-01	2.02E-01	2.01E-01	0.	0.	0.	
21000	4.15E-01	3.94E-01	3.69E-01	3.56E-01	3.48E-01	3.41E-01	3.37E-01	3.35E-01	3.33E-01	0.	0.	0.	
80000	1.62E-01	2.74E-01	2.78E-01	3.00E-01	3.13E-01	3.22E-01	3.26E-01	3.30E-01	3.31E-01	0.	0.	0.	
153000	1.01E-02	2.22E-02	3.91E-02	4.84E-02	5.48E-02	6.01E-02	6.33E-02	6.54E-02	6.54E-02	0.	0.	0.	

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM

TABLE 81. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 13+

STATE	LEVEL (CM-1)	LEVEL (EV)	STAT. WT.	TEMPERATURE (DEG K)									
				22000	26000	30000	34000	39000	43000	46000	50000	70000	
1s	0	0.	2	6.88E-01	6.37E-01	5.97E-01	5.64E-01	5.41E-01	5.20E-01	5.07E-01	4.89E-01	4.74E-01	
2s	22443	2.8098	4	3.12E-01	3.63E-01	4.03E-01	4.34E-01	4.59E-01	4.79E-01	4.92E-01	5.09E-01	5.24E-01	
2p	239000	29.6315	12	6.72E-07	6.89E-06	3.77E-05	1.30E-04	3.81E-04	8.48E-04	1.71E-03	3.82E-03	1.92E-02	
3s	407000	50.4403	10	7.47E-12	5.27E-10	7.99E-09	9.37E-08	5.49E-07	2.49E-06	7.43E-06	2.00E-05	5.86E-05	
3p	510000	63.2303	2	2.25E-15	3.52E-13	1.42E-11	2.40E-10	2.22E-09	1.34E-08	5.94E-08	2.07E-07	1.22E-05	
3d	540000	64.9497	6	9.48E-16	2.01E-13	1.01E-11	2.02E-10	2.14E-09	1.44E-08	5.97E-08	2.61E-07	1.97E-05	
3f	709000	87.9025	4	1.00E-20	1.16E-17	2.04E-15	1.06E-13	2.37E-12	2.95E-11	3.72E-10	4.00E-07	4.00E-07	
4s	805000	99.8047	10	4.70E-23	1.43E-19	5.11E-17	4.54E-15	1.57E-13	2.75E-12	4.22E-11	2.11E-10	1.42E-07	
4p	897000	111.2110	6	6.88E-26	5.29E-22	3.71E-19	5.54E-17	2.89E-15	7.05E-14	1.22E-13	9.03E-12	1.28E-09	
LEVEL				TEMPERATURE (DEG K)									
(CM-1)				40000	150000	500000	800000	1500000	3000000	5000000	8000000	0	0
0	3.95E-01	2.99E-01	1.48E-01	1.04E-01	7.44E-02	5.52E-02	4.41E-02	4.10E-02	3.99E-02	3.99E-02	3.99E-02	0.	0.
22443	5.94E-01	4.81E-01	3.02E-01	2.02E-01	1.47E-01	1.08E-01	8.15E-02	6.15E-02	7.75E-02	9.75E-02	9.75E-02	0.	0.
239000	5.19E-02	1.81E-01	3.21E-01	3.25E-01	2.98E-01	2.64E-01	2.40E-01	2.30E-01	2.24E-01	2.24E-01	2.24E-01	0.	0.
407000	2.95E-03	3.01E-02	1.20E-01	1.47E-01	1.84E-01	1.87E-01	1.84E-01	1.82E-01	1.81E-01	1.81E-01	1.81E-01	0.	0.
510000	1.14E-04	2.24E-03	1.44E-02	2.48E-02	3.05E-02	3.79E-02	3.51E-02	3.54E-02	3.54E-02	3.54E-02	3.54E-02	0.	0.
540000	2.11E-04	5.09E-03	3.79E-02	6.83E-02	8.67E-02	9.87E-02	1.04E-01	1.02E-01	1.04E-01	1.04E-01	1.04E-01	0.	0.
709000	9.44E-06	4.69E-04	1.12E-02	2.80E-02	4.27E-02	5.60E-02	6.30E-02	6.69E-02	6.86E-02	6.86E-02	6.86E-02	0.	0.
805000	5.09E-06	6.62E-04	1.77E-02	5.31E-02	9.98E-02	1.28E-01	1.52E-01	1.63E-01	1.69E-01	1.69E-01	1.69E-01	0.	0.
897000	7.01E-07	1.64E-04	6.84E-03	2.45E-02	4.54E-02	7.01E-02	8.74E-02	9.51E-02	9.95E-02	9.95E-02	9.95E-02	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUMLEVELS  
NONSTARRED ENERGY LEVELS FROM PRYCE (1964)

TABLE 82 ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 14+

STATE	LEVEL (CM-1)	LEVEL (EV)	STAT. WT.	TEMPERATURE (DEG K)									
				22000	26000	30000	34000	38000	42000	46000	50000	54000	70000
2s <sup>1</sup> S	0	0.	1	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00	1.00E-00
2p <sup>2</sup> P	234000*	29.2595	9	1.78E-06	1.92E-05	1.00E-04	4.14E-04	1.10E-03	2.77E-03	5.37E-03	1.00E-02	1.00E-02	9.34E-01
2p <sup>2</sup> P	450000*	59.7915	3	4.97E-13	4.59E-11	1.27E-09	1.61E-08	1.19E-07	6.04E-07	2.30E-06	7.04E-06	2.49E-05	2.49E-05
2p <sup>2</sup> P	620000*	76.8482	9	2.21E-17	1.13E-14	1.10E-12	3.63E-11	5.74E-10	5.34E-09	3.39E-08	1.59E-07	2.44E-05	2.44E-05
2p <sup>2</sup> D	870000*	85.0673	5	4.67E-19	3.95E-16	5.54E-14	2.43E-12	4.80E-11	5.37E-10	3.94E-09	2.10E-08	4.80E-08	4.80E-08
3s <sup>1</sup> S	876000*	102.9042	1	7.47E-24	1.13E-20	5.15E-18	5.57E-16	2.25E-14	4.47E-13	5.20E-12	4.20E-11	3.44E-08	3.44E-08

LEVEL: TEMPERATURE (DEG K)

LEVEL: (CM-1)	90000	150000	300000	500000	800000	1500000	3000000	5000000	8000000	0	0	0	0
0	8.27E-01	4.98E-01	2.03E-01	1.15E-01	7.75E-02	5.50E-02	4.44E-02	4.08E-02	3.89E-02	0.	0.	0.	0.
234000	1.71E-01	4.86E-01	5.89E-01	5.24E-01	4.54E-01	3.95E-01	3.38E-01	3.43E-01	3.35E-01	0.	0.	0.	0.
450000	1.86E-03	1.99E-02	7.03E-02	9.43E-02	1.04E-01	1.07E-01	1.08E-01	1.08E-01	1.08E-01	0.	0.	0.	0.
620000	3.69E-04	1.17E-02	9.34E-02	2.73E-01	2.09E-01	2.73E-01	2.98E-01	3.08E-01	3.13E-01	0.	0.	0.	0.
870000	4.22E-05	4.03E-03	4.08E-02	8.34E-02	1.18E-01	1.45E-01	1.62E-01	1.68E-01	1.72E-01	0.	0.	0.	0.
876000	1.43E-06	1.74E-04	3.79E-03	1.05E-02	1.74E-02	2.48E-02	2.99E-02	3.22E-02	3.39E-02	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
NONSTARRED ENERGY LEVELS FROM



TABLE 84. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 16+

STATE	LEVEL (CM-1)	STAT. WT.	TEMPERATURE (DEG K)									
			27000	30000	34000	38000	42000	46000	50000	70000		
1s <sup>0</sup>	0	1	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	
1s 2s	2430000*	16	0.	0.	0.	0.	0.	0.	0.	0.	0.	
1s 2p	2480000*	36	0.	0.	0.	0.	0.	0.	0.	0.	0.	
1s 3s	3040000*	64	0.	0.	0.	0.	0.	0.	0.	0.	0.	

LEVEL (CM-1)	TEMPERATURE (DEG K)									
	90000	150000	300000	500000	800000	1500000	3000000	5000000	8000000	0
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	0
24300000	0.	0.	0.	6.85E-30	1.68E-18	1.21E-09	1.39E-04	9.67E-01	5.97E-01	0.
24800000	0.	0.	0.	3.67E-35	1.15E-21	3.62E-11	3.61E-05	8.76E-03	1.21E-01	0.
30400000	0.	0.	0.	6.53E-37	1.15E-22	1.39E-11	2.98E-05	9.83E-03	1.61E-01	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
MONSTARRED ENERGY LEVELS FROM



TABLE 85. ENERGY LEVELS AND FRACTIONAL ELECTRONIC POPULATIONS OF AR 17\*

STATE	LEVEL (CM-1)	LEVEL (EV)	STAT. WT.	TEMPERATURE (DEG K)									
				22000	26000	30000	34000	38000	42000	46000	50000	54000	58000
1s	0	0.	2	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
2s	26764214	3118.2540	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2p	26788837	3221.3068	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3s	31732440	3934.2444	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3p	31739934	3935.1488	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3d	31744034	3935.9051	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4s	33470098	4149.6562	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4p	33473174	4150.0376	6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4d	33475746	4150.3564	10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4f	33476844	4150.4926	14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

LEVEL (CM-1)	150000	300000	500000	800000	1500000	3000000	5000000	8000000	15000000	30000000	50000000	80000000	150000000
0	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
26764214	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
26788837	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
31732440	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
31739934	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
31744034	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
33470098	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
33473174	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
33475746	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
33476844	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

\*ESTIMATED \*\*INCLUDES ESTIMATED SUBLEVELS  
MINI-STARRED ENERGY LEVELS FROM GARCIA AND MACK (1965)

TABLE 86. DIATOMIC SPECTROSCOPIC CONSTANTS (UNITS: CM-1)

MOL. STATE	$T_0$	$\omega_e$	$\omega_e x_e$	$\omega_e y_e$	$\omega_e^2$	$B_e$	$\alpha_e$	$\gamma_e$	$\delta_e$
$N_2$									
$X^1\Sigma_g^+$	0.	2358.070	14.1880	-1.240E-02	-0.	1.99870	0.0178000	-0.	-0.
$A^3\Sigma_u^+$	49756.6	1460.600	13.8500	6.500E-03	1.800E-03	1.45450	0.0179400	-9.200E-05	-0.
$B^3\Delta_u$	58000.0	1490.900	13.0000	-0.	-0.	1.46000	0.0170090	-0.	-0.
$B^3\Pi_g$	59313.4	1723.880	14.3500	-1.100E-02	2.000E-04	1.63750	0.0179400	-7.400E-05	-0.
$B^3\Sigma_u^-$	65852.3	1516.883	12.1810	4.186E-02	7.323E-04	1.47359	0.0168610	3.619E-05	9.460E-07
$a^1\Sigma_u^-$	67739.3	1530.254	12.0747	4.129E-02	2.896E-04	1.47984	0.0165740	2.410E-05	-0.
$a^1\Pi_g$	68951.2	1696.200	13.9491	7.935E-03	-2.911E-04	1.61688	0.0179330	-2.930E-05	-0.
$w^1\Delta_u$	71698.3	1558.580	11.5300	-4.000E-02	-4.800E-03	1.49830	0.0166500	-0.	-0.
$N_2^+$									
$X^2\Sigma_g^+$	0.	2207.170	16.1460	-2.850E-02	9.200E-04	1.92580	0.0174300	-1.640E-04	-0.
$A^2\Pi_u$	8068.0	1903.420	15.0000	-0.	-0.	1.74800	0.0200000	-0.	-0.
$B^2\Sigma_u^+$	25586.0	2418.700	22.5300	-6.700E-01	4.000E-02	2.08300	0.0183000	-1.650E-03	-0.
$4\Sigma_u^+$	44328.0	1700.000	16.0000	-0.	-0.	1.60000	0.0200000	-0.	-0.
$4\Delta_u$	51328.0	1600.000	14.0000	-0.	-0.	1.80000	0.0200000	-0.	-0.
$D^2\Pi_g$	51203.0	914.780	13.1200	8.300E-02	-0.	1.11300	0.0200000	-0.	-0.
$4\Sigma_u^-$	60328.0	1500.000	14.0000	-0.	-0.	1.40000	0.0150000	-0.	-0.
$C^2\Sigma_u^+$	64542.0	2073.700	10.9700	-2.400E-01	-0.	1.51240	0.0017000	-7.500E-04	-0.

TABLE 86 (CONT.). DIATOMIC SPECTROSCOPIC CONSTANTS

MOLEC.	STATE	$T_0$	$\omega_0$	$\omega_{x_0}$	$\omega_{y_0}$	$\omega_{z_0}$	$B_0$	$\alpha_0$	$\gamma_0$	$\delta_0$
NO	X $^2\Pi$	62.2	1903.980	14.0150	1.000E-02	-5.800E-04	1.70420	0.0172500	-4.000E-05	-0.
	a $^4\Pi$	37965.0	1017.060	11.0000	-0.	-0.	1.17000	0.0170000	-0.	-0.
	A $^2\Sigma^+$	44199.2	2374.860	16.4600	-0.	-0.	1.99720	0.0192800	-0.	-0.
	B $^3\Pi$	45505.0	1037.640	7.5450	8.330E-02	-0.	1.12450	0.0132000	-0.	-0.
	b $^4\Sigma^-$	47092.0	1203.000	14.5000	-0.	-0.	1.36000	0.0240000	-0.	-0.
	C $^3\Pi$	52380.0	2395.000	15.0000	-0.	-0.	2.00200	0.0300000	-0.	-0.
	D $^2\Sigma^+$	53291.2	2323.900	22.8850	7.500E-01	2.200E-01	2.00260	0.0217500	-0.	-0.
HO <sup>+</sup>	X $^1\Sigma^+$	0.	2377.100	16.3500	1.000E-02	-0.	2.00200	0.0202000	-0.	-0.
	a $^2\Sigma^+$	39934.0	1600.000	14.0000	-0.	-0.	1.65000	0.0200000	-0.	-0.
	B $^3\Sigma$	56804.0	2000.000	14.0000	-0.	-0.	1.50000	0.0200000	-0.	-0.
	B $^3\Pi$	63764.0	1700.000	14.0000	-0.	-0.	1.84000	0.0200000	-0.	-0.
	A $^1\Pi$	73084.0	1608.900	23.3000	-0.	-0.	1.58700	0.0240000	-0.	-0.
	B $^2\Sigma^-$	73334.0	1200.000	12.0000	-0.	-0.	1.22000	0.0150000	-0.	-0.

TABLE 87. IDEAL GAS FUNCTIONS FOR N<sub>2</sub> (MOLECULAR WEIGHT 28.0134, R = 1.98717 CAL./MOLE, 8 STATES INCLUDED)

TEMP. (°K)	PARTIT. FUNCT.	$\frac{H^0-E^0}{RT}$	$-\frac{F^0-E^0}{RT}$	$\Delta S^0$	$\ln \frac{H^0-E^0}{RT} - \frac{F^0-E^0}{RT}$	$\ln \frac{H^0-E^0}{RT} - \frac{F^0-E^0}{RT}$	$\ln \frac{H^0-E^0}{RT} - \frac{F^0-E^0}{RT}$	$\ln \frac{H^0-E^0}{RT} - \frac{F^0-E^0}{RT}$	$\ln \frac{H^0-E^0}{RT} - \frac{F^0-E^0}{RT}$	$\ln \frac{H^0-E^0}{RT} - \frac{F^0-E^0}{RT}$	TEMP. (°K)
1000	1-8159E 02	3.62519	23.8052	27.4294	7.20187	47.3049	54.5048	5.2147E 03	7.2018E 03	4.7305E 04	1000
1200	2-2413E 02	3.68633	24.4715	28.1578	7.32534	48.6289	55.9543	6.4058E 03	8.7904E 03	5.9355E 04	1200
1400	2-7033E 02	3.74630	25.0443	28.7906	7.44452	49.7672	57.2117	7.6403E 03	1.0422E 04	6.7674E 04	1400
1600	3-2046E 02	3.80178	25.5482	29.3500	7.55476	50.7485	58.3233	8.9082E 03	1.2088E 04	7.6123E 04	1600
1800	3-7467E 02	3.85210	25.9980	29.8511	7.65477	51.6442	59.3190	1.0202E 04	1.3779E 04	8.4946E 04	1800
2000	4-3307E 02	3.89741	26.4072	30.3046	7.74480	52.4795	60.2203	1.1515E 04	1.5490E 04	9.4095E 04	2000
2200	4-9572E 02	3.93781	26.7806	30.7187	7.82568	53.2515	61.0632	1.2845E 04	1.7217E 04	1.0370E 05	2200
2400	5-6270E 02	3.97474	27.1249	31.0986	7.89846	53.9916	61.8001	1.4187E 04	1.8954E 04	1.1306E 05	2400
2600	6-3404E 02	4.00778	27.4444	31.4521	7.96411	54.7348	62.5004	1.5540E 04	2.0707E 04	1.2199E 05	2600
2800	7-0979E 02	4.03768	27.7425	31.7802	8.02354	55.1289	63.1824	1.6902E 04	2.2486E 04	1.3043E 05	2800
3000	7-8997E 02	4.06488	28.0220	32.0869	8.07758	55.6843	63.7619	1.8271E 04	2.4233E 04	1.3850E 05	3000
3200	8-7463E 02	4.08971	28.2851	32.3748	8.12692	56.2072	64.3342	1.9647E 04	2.5980E 04	1.4617E 05	3200
3400	9-6378E 02	4.11247	28.5338	32.6462	8.17215	56.7013	64.8735	2.1029E 04	2.7785E 04	1.5347E 05	3400
3600	1-0575E 03	4.13342	28.7694	32.9028	8.21379	57.1696	65.3834	2.2416E 04	2.9570E 04	1.6031E 05	3600
3800	1-1587E 03	4.15278	28.9934	33.1462	8.25227	57.6147	65.8670	2.3807E 04	3.1359E 04	1.6694E 05	3800
4000	1-2585E 03	4.17075	29.2069	33.3776	8.28794	58.0389	66.3269	2.5203E 04	3.3152E 04	1.7316E 05	4000
4200	1-3660E 03	4.18747	29.4108	33.5983	8.32119	58.4441	66.7653	2.6603E 04	3.4949E 04	1.7894E 05	4200
4400	1-4781E 03	4.20309	29.6040	33.8091	8.35224	58.8320	67.1842	2.8004E 04	3.6750E 04	1.8426E 05	4400
4600	1-5948E 03	4.21774	29.7931	34.0109	8.38134	59.2039	67.5852	2.9401E 04	3.8554E 04	1.8914E 05	4600
4800	1-7163E 03	4.23152	29.9729	34.2045	8.40873	59.5612	67.9699	3.0824E 04	4.0362E 04	1.9369E 05	4800
5000	1-8425E 03	4.24453	30.1459	34.3905	8.43458	59.9050	68.3393	3.2237E 04	4.2172E 04	1.9792E 05	5000
5200	1-9735E 03	4.25684	30.3127	34.5695	8.45908	60.2363	68.6953	3.3654E 04	4.3987E 04	2.0187E 05	5200
5400	2-1092E 03	4.26859	30.4755	34.7421	8.48239	60.5559	69.0383	3.5074E 04	4.5802E 04	2.0554E 05	5400
5600	2-2498E 03	4.27978	30.6290	34.9088	8.50464	60.8648	69.3685	3.6498E 04	4.7624E 04	2.0894E 05	5600
5800	2-3952E 03	4.29051	30.7793	35.0699	8.52596	61.1636	69.6866	3.7925E 04	4.9451E 04	2.1213E 05	5800
6000	2-5456E 03	4.30085	30.9250	35.2258	8.54650	61.4530	69.9955	3.9354E 04	5.1279E 04	2.1517E 05	6000
6200	2-7009E 03	4.31087	31.0662	35.3770	8.56642	61.7336	70.2980	4.0791E 04	5.3112E 04	2.1807E 05	6200
6400	2-8611E 03	4.32064	31.2032	35.5236	8.58582	62.0059	70.5917	4.2231E 04	5.4949E 04	2.2084E 05	6400
6600	3-0265E 03	4.33021	31.3363	35.6665	8.60484	62.2704	70.8752	4.3677E 04	5.6792E 04	2.2348E 05	6600
6800	3-1969E 03	4.33967	31.4657	35.8054	8.62364	62.5275	71.1512	4.5126E 04	5.8641E 04	2.2593E 05	6800
7000	3-3724E 03	4.34907	31.5916	35.9407	8.64233	62.7778	71.4201	4.6584E 04	6.0494E 04	2.2824E 05	7000
7200	3-5532E 03	4.35850	31.7143	36.0728	8.66107	63.0215	71.6826	4.8052E 04	6.2346E 04	2.3046E 05	7200
7400	3-7393E 03	4.36802	31.8338	36.2018	8.67998	63.2591	71.9390	4.9527E 04	6.4232E 04	2.3259E 05	7400
7600	3-9308E 03	4.37771	31.9504	36.3282	8.69924	63.4908	72.1900	5.1012E 04	6.6114E 04	2.3463E 05	7600
7800	4-1278E 03	4.38765	32.0643	36.4519	8.71899	63.7170	72.4340	5.2506E 04	6.8006E 04	2.3659E 05	7800
8000	4-3305E 03	4.39791	32.1755	36.5734	8.73938	63.9380	72.6774	5.4018E 04	6.9915E 04	2.3846E 05	8000
8200	4-5488E 03	4.40854	32.2842	36.6928	8.76054	64.1541	72.9144	5.5542E 04	7.1834E 04	2.4024E 05	8200
8400	4-7531E 03	4.41967	32.3906	36.8103	8.78242	64.3654	73.1481	5.7082E 04	7.3774E 04	2.4194E 05	8400
8600	4-9734E 03	4.43133	32.4947	36.9260	8.80578	64.5724	73.3782	5.8640E 04	7.5730E 04	2.4357E 05	8600
8800	5-1999E 03	4.44358	32.5967	37.0403	8.83013	64.7751	73.6052	6.0218E 04	7.7705E 04	2.4513E 05	8800
9000	5-4320E 03	4.45631	32.6967	37.1532	8.85583	64.9738	73.8294	6.1810E 04	7.9702E 04	2.4662E 05	9000
9200	5-6724E 03	4.47018	32.7948	37.2650	8.88298	65.1688	74.0517	6.3422E 04	8.1723E 04	2.4804E 05	9200
9400	5-9180E 03	4.48463	32.8911	37.3758	8.91170	65.3601	74.2718	6.5051E 04	8.3770E 04	2.4940E 05	9400
9600	6-1723E 03	4.49953	32.9857	37.4856	8.94211	65.5480	74.4901	6.6707E 04	8.5844E 04	2.5070E 05	9600
9800	6-4333E 03	4.51612	33.0786	37.5946	8.97427	65.7327	74.7070	6.8374E 04	8.7948E 04	2.5194E 05	9800

TABLE N7 (CONT.). IDEAL GAS FUNCTIONS FOR N<sub>2</sub>

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2-E^0}{RT}$	$-\frac{h^2-E^0}{RT}$	$5R$	$(h^2-E^0)_{CAL}$	$-\ln \frac{(h^2-E^0)_{CAL}}{RT}$	$S^0$	$E^0-E^0_{CAL}$	$h^2-E^0_{CAL}$	$-(h^2-E^0)$	TEMP. (°K)
10000	6.7019E 03	4.53323	33.1701	37.7033	9.00829	65.9144	76.9227	7.0211E 04	9.0003E 04	4.5914E 05	10000
10500	7.4090E 03	4.58026	33.3924	37.9728	9.10178	66.3561	77.4379	7.4703E 04	9.5349E 04	4.9674E 05	10500
11000	8.1718E 03	4.63360	33.6064	38.2402	9.20172	66.7819	77.9897	7.9428E 04	1.0128E 05	5.7227E 05	11000
11500	8.9933E 03	4.69315	33.8139	38.5070	9.32666	67.1934	78.5199	8.4272E 04	1.0723E 05	7.7227E 05	11500
12000	9.8900E 03	4.75857	34.0150	38.7734	9.45607	67.5934	79.0495	8.8927E 04	1.1347E 05	8.1112E 05	12000
12500	1.0841E 04	4.82920	34.2107	39.0399	9.59642	67.9823	79.5787	9.3116E 04	1.1994E 05	8.4978E 05	12500
13000	1.1917E 04	4.90413	34.4015	39.3057	9.74532	68.3615	80.1068	1.0083E 05	1.2649E 05	9.2786E 05	13000
13500	1.3047E 04	4.98223	34.5881	39.5703	9.90352	68.7322	80.6327	1.0683E 05	1.3344E 05	9.2786E 05	13500
14000	1.4323E 04	5.06227	34.7707	39.8330	10.05937	69.0951	81.1547	1.1301E 05	1.4083E 05	9.6733E 05	14000
14500	1.5692E 04	5.14293	34.9497	40.0927	10.21986	69.4509	81.6708	1.1937E 05	1.4811E 05	1.0079E 06	14500
15000	1.7184E 04	5.22294	35.1255	40.3484	10.37625	69.8001	82.1789	1.2589E 05	1.5540E 05	1.0470E 06	15000
15500	1.8814E 04	5.30107	35.2980	40.5991	10.53111	70.1430	82.6771	1.3248E 05	1.6260E 05	1.0872E 06	15500
16000	2.0590E 04	5.37625	35.4675	40.8437	10.68331	70.4798	83.1633	1.3914E 05	1.6984E 05	1.1277E 06	16000
16500	2.2520E 04	5.44735	35.6340	41.0814	10.83318	70.8107	83.6559	1.4583E 05	1.7704E 05	1.1684E 06	16500
17000	2.4616E 04	5.51420	35.7977	41.3115	10.97962	71.1359	84.1395	1.5256E 05	1.8428E 05	1.2093E 06	17000
17500	2.6888E 04	5.57563	35.9584	41.5340	11.07970	71.4553	84.6140	1.5912E 05	1.9180E 05	1.2506E 06	17500
18000	2.9345E 04	5.63145	36.1163	41.7477	11.19082	71.7690	85.0796	1.6566E 05	2.0143E 05	1.2918E 06	18000
18500	3.1994E 04	5.68142	36.2713	41.9527	11.28992	72.0770	85.5469	1.7210E 05	2.0886E 05	1.3334E 06	18500
19000	3.4850E 04	5.72544	36.4234	42.1488	11.37740	72.3793	86.0157	1.7841E 05	2.1617E 05	1.3752E 06	19000
19500	3.7915E 04	5.76355	36.5725	42.3361	11.45313	72.6758	86.4789	1.8459E 05	2.2334E 05	1.4172E 06	19500
20000	4.1190E 04	5.79588	36.7189	42.5148	11.51738	72.9664	86.9440	1.9060E 05	2.3033E 05	1.4593E 06	20000
20500	4.4641E 04	5.87230	37.2754	43.1479	11.64923	73.2519	87.4119	2.1301E 05	2.5672E 05	1.6296E 06	20500
21000	4.8313E 04	5.87963	37.7872	43.6449	11.83379	73.5395	87.8733	2.3272E 05	2.8041E 05	1.8021E 06	21000
21500	5.2299E 04	5.83899	38.2545	44.0955	11.60304	73.8220	88.3387	2.5001E 05	3.0166E 05	1.9764E 06	21500
22000	5.6785E 04	5.76785	38.6868	44.4544	11.44164	74.0770	88.7949	2.6529E 05	3.2093E 05	2.1524E 06	22000
22500	6.1878E 04	5.67885	39.0818	44.7606	11.28481	74.3419	89.2434	2.7893E 05	3.3854E 05	2.3299E 06	22500
23000	6.7434E 04	5.58058	39.4452	45.0257	11.08954	74.6041	89.6734	2.9128E 05	3.5487E 05	2.5083E 06	23000
23500	7.3533E 04	5.47885	39.7804	45.2591	10.86918	74.8648	90.0933	3.0259E 05	3.7014E 05	2.6877E 06	23500
24000	7.9991E 04	5.37638	40.0907	45.4673	10.64916	75.1248	90.5030	3.1309E 05	3.8443E 05	2.8686E 06	24000
24500	8.6808E 04	5.27655	40.3787	45.6552	10.43538	75.3848	90.9030	3.2293E 05	3.9844E 05	3.0491E 06	24500
25000	9.3999E 04	5.17983	40.6469	45.8267	10.29317	75.6440	91.2931	3.3224E 05	4.1173E 05	3.2301E 06	25000

TABLE 88. IDEAL GAS FUNCTIONS FOR N<sub>2</sub>\* (MOLECULAR WEIGHT 28.0129, R = 1.98717 CAL/MOLE, 8 STATES INCLUDED)

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2}{8\pi^2 I}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0}$	$\frac{h^2}{8\pi^2 I} - \frac{h^2}{8\pi^2 I_0}$	TEMP. (°K)
1000	3.8059E 02	3.64675	24.5451	28.1918	7.24669	48.7751	56.0218	5.2595E 03	7.2467E 03	1000
1200	4.7189E 02	3.71419	25.2159	28.9301	7.38071	50.1082	57.4899	6.4723E 03	7.2467E 03	1200
1400	5.7181E 02	3.78001	25.7934	29.5734	7.51151	51.2558	58.7873	7.6473E 03	7.2467E 03	1400
1600	6.8124E 02	3.84396	26.3024	30.1463	7.63859	52.3697	59.9957	8.8723E 03	7.2467E 03	1600
1800	8.0100E 02	3.90693	26.7588	30.6457	7.76372	53.4741	60.1235	1.0390E 04	7.2467E 03	1800
2000	9.3201E 02	3.96982	27.1736	31.1435	7.88868	54.5785	61.8872	1.1803E 04	7.2467E 03	2000
2200	1.0753E 03	4.03303	27.5550	31.6447	8.01430	55.6829	63.5995	1.3246E 04	7.2467E 03	2200
2400	1.2321E 03	4.09653	27.9086	32.0951	8.14048	56.7873	65.1237	1.4748E 04	7.2467E 03	2400
2600	1.4034E 03	4.15991	28.2390	32.5969	8.26662	57.8917	66.5738	1.6326E 04	7.2467E 03	2600
2800	1.5910E 03	4.22257	28.5496	32.7722	8.39094	58.9961	67.8281	1.7931E 04	7.2467E 03	2800
3000	1.7959E 03	4.28389	28.8430	33.1269	8.51200	60.1005	69.0425	1.9577E 04	7.2467E 03	3000
3200	2.0183E 03	4.34326	29.1214	33.4647	8.63017	61.2049	70.2069	2.1246E 04	7.2467E 03	3200
3400	2.2510E 03	4.40018	29.3864	33.7866	8.74588	62.3093	71.3813	2.2941E 04	7.2467E 03	3400
3600	2.5243E 03	4.45425	29.6395	34.0937	8.85933	63.4137	72.5557	2.4661E 04	7.2467E 03	3600
3800	2.8095E 03	4.50524	29.8817	34.3869	8.97055	64.5181	73.7301	2.6406E 04	7.2467E 03	3800
4000	3.1177E 03	4.55299	30.1140	34.6670	9.07982	65.6225	74.9045	2.8176E 04	7.2467E 03	4000
4200	3.4496E 03	4.59747	30.3372	34.9347	9.18763	66.7269	76.0789	2.9971E 04	7.2467E 03	4200
4400	3.8072E 03	4.63873	30.5521	35.1908	9.29329	67.8293	77.2533	3.1791E 04	7.2467E 03	4400
4600	4.1904E 03	4.67684	30.7591	35.4360	9.39695	68.9317	78.4277	3.3636E 04	7.2467E 03	4600
4800	4.6007E 03	4.71201	30.9589	35.6709	9.49861	70.0341	79.6021	3.5506E 04	7.2467E 03	4800
5000	5.0389E 03	4.74436	31.1519	35.8963	9.59827	71.1365	80.7765	3.7401E 04	7.2467E 03	5000
5200	5.5057E 03	4.77411	31.3386	36.1127	9.69593	72.2389	81.9509	3.9321E 04	7.2467E 03	5200
5400	6.0022E 03	4.80146	31.5193	36.3208	9.79159	73.3413	83.1253	4.1266E 04	7.2467E 03	5400
5600	6.5292E 03	4.82641	31.6944	36.5210	9.88525	74.4437	84.2997	4.3236E 04	7.2467E 03	5600
5800	7.0875E 03	4.84978	31.8642	36.7140	9.97691	75.5461	85.4741	4.5231E 04	7.2467E 03	5800
6000	7.6780E 03	4.87117	32.0289	36.9001	10.06657	76.6485	86.6485	4.7251E 04	7.2467E 03	6000
6200	8.3015E 03	4.89096	32.1890	37.0800	10.15423	77.7509	87.8229	4.9296E 04	7.2467E 03	6200
6400	8.9599E 03	4.90933	32.3446	37.2539	10.24089	78.8533	88.9973	5.1366E 04	7.2467E 03	6400
6600	9.6509E 03	4.92645	32.4959	37.4224	10.32655	79.9557	90.1717	5.3461E 04	7.2467E 03	6600
6800	1.0378E 04	4.94247	32.6432	37.5857	10.41121	81.0581	91.3461	5.5581E 04	7.2467E 03	6800
7000	1.1142E 04	4.95753	32.7867	37.7442	10.49487	82.1605	92.5205	5.7726E 04	7.2467E 03	7000
7200	1.1943E 04	4.97176	32.9264	37.8983	10.57753	83.2629	93.6949	5.9896E 04	7.2467E 03	7200
7400	1.2781E 04	4.98528	33.0630	38.0483	10.65919	84.3653	94.8693	6.2091E 04	7.2467E 03	7400
7600	1.3661E 04	4.99818	33.1961	38.1943	10.73985	85.4677	96.0437	6.4311E 04	7.2467E 03	7600
7800	1.4579E 04	5.01055	33.3261	38.3364	10.81951	86.5701	97.2181	6.6556E 04	7.2467E 03	7800
8000	1.5538E 04	5.02247	33.4531	38.4756	10.89817	87.6725	98.3925	6.8826E 04	7.2467E 03	8000
8200	1.6539E 04	5.03400	33.5773	38.6113	10.97583	88.7749	99.5669	7.1121E 04	7.2467E 03	8200
8400	1.7583E 04	5.04520	33.6987	38.7439	11.05249	89.8773	100.7413	7.3441E 04	7.2467E 03	8400
8600	1.8671E 04	5.05612	33.8175	38.8737	11.12815	90.9797	101.9157	7.5786E 04	7.2467E 03	8600
8800	1.9803E 04	5.06678	33.9339	39.0007	11.20281	92.0821	103.0901	7.8156E 04	7.2467E 03	8800
9000	2.0982E 04	5.07721	34.0479	39.1251	11.27647	93.1845	104.2645	8.0551E 04	7.2467E 03	9000
9200	2.2207E 04	5.08745	34.1596	39.2470	11.34913	94.2869	105.4389	8.2971E 04	7.2467E 03	9200
9400	2.3480E 04	5.09749	34.2691	39.3666	11.42079	95.3893	106.6133	8.5416E 04	7.2467E 03	9400
9600	2.4802E 04	5.10735	34.3765	39.4839	11.49145	96.4917	107.7877	8.7886E 04	7.2467E 03	9600
9800	2.6175E 04	5.11703	34.4819	39.5990	11.56111	97.5941	108.9621	9.0381E 04	7.2467E 03	9800
10000	2.7600E 04	5.12651	34.5873	39.7125	11.63077	98.6965	110.1365	9.2901E 04	7.2467E 03	10000

TABLE 88 (CONT.). IDEAL GAS FUNCTIONS FOR N<sub>2</sub>

TEMP. (°C)	PARIT. PUNCT.	H <sub>2</sub> -S <sub>2</sub> RT	-S <sub>2</sub> -S <sub>2</sub> RT	S <sub>2</sub> H	H <sub>2</sub> -S <sub>2</sub> VT -CAL/MOLE	-H <sub>2</sub> -S <sub>2</sub> VT -CAL/MOLE	S <sub>2</sub> -S <sub>2</sub> -CAL/MOLE	H <sub>2</sub> -S <sub>2</sub> -CAL/MOLE	(H <sub>2</sub> -S <sub>2</sub> ) (°C)
10000	2.7599E 04	5.12652	34.5854	39.7119	10.18724	46.7270	78.9152	1.0719E 05	6.8727E 05
10500	3.1390E 04	5.16938	34.8361	39.9855	10.23358	46.7251	79.4578	1.0744E 05	7.2604E 05
11000	3.5825E 04	5.17087	35.0747	40.2470	10.27316	46.7231	80.0000	1.1062E 05	7.6467E 05
11500	4.0021E 04	5.19075	35.3065	40.4972	10.31488	46.7190	80.5477	1.1368E 05	8.0368E 05
12000	4.4894E 04	5.20574	35.5378	40.7365	10.35807	46.7199	81.0902	1.1642E 05	8.4719E 05
12500	4.9616E 04	5.22465	35.7607	40.9654	10.39225	46.7197	81.6300	1.1897E 05	8.8779E 05
13000	5.5032E 04	5.23822	35.9859	41.1841	10.40922	46.7195	82.1695	1.2135E 05	9.2604E 05
13500	6.0242E 04	5.24934	36.1636	41.3931	10.43127	46.7187	82.7090	1.2358E 05	9.6262E 05
14000	6.5474E 04	5.25784	36.3349	41.5927	10.44819	46.7180	83.2485	1.2478E 05	9.9762E 05
14500	7.0410E 04	5.26373	36.5195	41.7832	10.45990	46.7173	83.7880	1.2598E 05	1.0316E 06
15000	7.5023E 04	5.26760	36.6980	41.9650	10.46640	46.7165	84.3275	1.2719E 05	1.0659E 06
15500	8.0490E 04	5.27059	36.8707	42.1384	10.46778	46.7157	84.8670	1.2829E 05	1.1000E 06
16000	8.6017E 04	5.27289	37.0380	42.3038	10.46420	46.7149	85.4065	1.2939E 05	1.1340E 06
16500	9.1781E 04	5.27452	37.1999	42.4617	10.45590	46.7141	85.9460	1.3049E 05	1.1680E 06
17000	1.0710E 05	5.27530	37.3569	42.6122	10.44314	46.7133	86.4855	1.3159E 05	1.2020E 06
17500	1.2678E 05	5.26679	37.5091	42.7559	10.42622	46.7125	87.0250	1.3269E 05	1.2360E 06
18000	1.4968E 05	5.23633	37.6568	42.8931	10.40595	46.7117	87.5645	1.3379E 05	1.2700E 06
18500	1.7460E 05	5.22810	37.8001	43.0242	10.38116	46.7109	88.1040	1.3489E 05	1.3040E 06
19000	1.9669E 05	5.21027	37.9392	43.1495	10.35361	46.7101	88.6435	1.3599E 05	1.3380E 06
19500	1.7023E 05	5.19498	38.0764	43.2684	10.32329	46.7093	89.1830	1.3709E 05	1.3720E 06
20000	1.8222E 05	5.17841	38.2057	43.3841	10.29035	46.7085	89.7225	1.3819E 05	1.4060E 06
22000	2.2459E 05	5.10198	38.6958	43.7978	10.13847	46.7084	87.0734	1.4060E 05	1.5184E 06
24000	2.9278E 05	5.01508	39.1360	44.1511	9.96580	46.7083	84.4243	1.4300E 05	1.6308E 06
26000	3.5669E 05	4.92352	39.5339	44.5474	9.76380	46.7082	81.7753	1.4540E 05	1.7432E 06
28000	4.2566E 05	4.83115	39.8953	44.9726	9.60034	46.7081	79.1262	1.4780E 05	1.8556E 06
30000	4.9939E 05	4.74043	40.2256	45.4260	9.47001	46.7080	76.4771	1.5020E 05	1.9680E 06
32000	5.7430E 05	4.65280	40.5287	45.9115	9.37888	46.7079	73.8280	1.5260E 05	2.0804E 06
34000	6.5271E 05	4.56907	40.8082	46.3773	9.27950	46.7078	71.1789	1.5500E 05	2.1928E 06
36000	7.3599E 05	4.48961	41.0671	46.8567	9.12159	46.7077	68.5298	1.5740E 05	2.3052E 06
38000	8.1458E 05	4.41452	41.3078	47.3223	8.97239	46.7076	65.9807	1.5980E 05	2.4176E 06
40000	8.9700E 05	4.34376	41.5324	47.8762	8.83177	46.7075	63.4316	1.6220E 05	2.5300E 06





TABLE B9 (CONT.). IDEAL GAS FUNCTIONS FOR NO

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2}{RT}$	$\ln \frac{h^2}{RT}$	$\ln \frac{h^2}{RT} - \ln \frac{h^2}{RT}$	$\ln \frac{h^2}{RT} - \ln \frac{h^2}{RT}$	$\ln \frac{h^2}{RT} - \ln \frac{h^2}{RT}$	$\ln \frac{h^2}{RT} - \ln \frac{h^2}{RT}$	TEMP. (°K)
10000	7.9451E 04	4.82983	35.7421	40.3719	9.20024	71.0255	80.2237	7.2131E 04
10500	8.7874E 04	4.85441	35.9487	40.4751	9.25346	71.5757	80.7287	7.2670E 04
11000	9.7205E 04	4.88088	36.1858	40.8647	9.30169	71.9973	81.2099	7.3232E 04
11500	1.0715E 05	4.70285	36.3944	41.0973	9.34355	72.3217	81.6671	7.3819E 04
12000	1.1773E 05	4.72207	36.5950	41.3170	9.38353	72.7203	82.1036	7.4434E 04
12500	1.2894E 05	4.73834	36.7881	41.5264	9.41937	73.1040	82.5199	7.5079E 04
13000	1.4083E 05	4.75159	36.9742	41.7258	9.45219	73.5736	82.9140	7.5754E 04
13500	1.5333E 05	4.76180	37.1537	41.9155	9.48247	74.0306	83.2931	7.6460E 04
14000	1.6652E 05	4.76902	37.3270	42.0960	9.51064	74.4750	83.6518	7.7198E 04
14500	1.8033E 05	4.77335	37.4945	42.2678	9.53696	74.9077	83.9931	7.7968E 04
15000	1.9479E 05	4.77695	37.6563	42.4313	9.56161	75.3293	84.3180	7.8770E 04
15500	2.0987E 05	4.77997	37.8129	42.5869	9.58467	75.7405	84.6271	7.9604E 04
16000	2.2557E 05	4.78241	37.9644	42.7360	9.60629	76.1415	84.9211	8.0470E 04
16500	2.4188E 05	4.78436	38.1111	42.8782	9.62666	76.5331	85.2021	8.1370E 04
17000	2.5877E 05	4.78571	38.2533	43.0168	9.64596	76.9156	85.4795	8.2304E 04
17500	2.7633E 05	4.78656	38.3910	43.1502	9.66438	77.2893	85.7547	8.3272E 04
18000	2.9459E 05	4.78720	38.5246	43.2789	9.68190	77.6544	86.0284	8.4274E 04
18500	3.1358E 05	4.78761	38.6543	43.3791	9.69859	78.0124	86.2914	8.5310E 04
19000	3.3334E 05	4.78781	38.7801	43.4613	9.71444	78.3625	86.5453	8.6380E 04
19500	3.5381E 05	4.78781	38.9023	43.5367	9.72952	78.7053	86.7903	8.7484E 04
20000	3.7513E 05	4.78769	39.0210	43.7017	9.74388	79.0412	87.0272	8.8622E 04
20500	3.9728E 05	4.78735	39.1359	43.8569	9.75752	79.3703	87.2572	8.9794E 04
21000	4.2028E 05	4.78681	39.2469	44.0074	9.77044	79.6928	87.4814	9.0999E 04
21500	4.4413E 05	4.78607	39.3542	44.1541	9.78264	79.9971	87.6999	9.2238E 04
22000	4.6884E 05	4.78513	39.4577	44.2969	9.79412	80.2936	87.9127	9.3510E 04
22500	4.9441E 05	4.78400	39.5574	44.4361	9.80488	80.5817	88.1200	9.4814E 04
23000	5.2084E 05	4.78268	39.6533	44.5717	9.81492	80.8617	88.3224	9.6150E 04
23500	5.4814E 05	4.78118	39.7457	44.7040	9.82424	81.1331	88.5199	9.7518E 04
24000	5.7631E 05	4.77951	39.8346	44.8331	9.83284	81.3955	88.7127	9.8918E 04
24500	6.0534E 05	4.77768	39.9199	44.9590	9.84072	81.6487	88.9000	1.0050E 05
25000	6.3524E 05	4.77570	40.0017	45.0817	9.84788	81.8927	89.0827	1.1224E 05
25500	6.6601E 05	4.77357	40.0800	45.2014	9.85432	82.1277	89.2600	1.2446E 05
26000	6.9764E 05	4.77130	40.1549	45.3182	9.86004	82.3537	89.4327	1.3718E 05
26500	7.3014E 05	4.76889	40.2264	45.4321	9.86504	82.5707	89.5999	1.5040E 05
27000	7.6351E 05	4.76634	40.2946	45.5431	9.86932	82.7787	89.7617	1.6412E 05
27500	7.9774E 05	4.76365	40.3595	45.6514	9.87288	82.9777	89.9184	1.7834E 05
28000	8.3284E 05	4.76082	40.4211	45.7571	9.87572	83.1687	90.0700	1.9306E 05
28500	8.6881E 05	4.75785	40.4794	45.8604	9.87784	83.3513	90.2167	2.0828E 05
29000	9.0564E 05	4.75474	40.5344	45.9614	9.87924	83.5263	90.3584	2.2400E 05
29500	9.4334E 05	4.75149	40.5861	46.0601	9.87992	83.6937	90.4951	2.4022E 05
30000	9.8191E 05	4.74810	40.6346	46.1564	9.88000	83.8535	90.6267	2.5694E 05
30500	1.0211E 06	4.74457	40.6799	46.2504	9.87948	84.0057	90.7531	2.7416E 05
31000	1.0634E 06	4.74090	40.7220	46.3421	9.87836	84.1503	90.8754	2.9188E 05
31500	1.1069E 06	4.73709	40.7609	46.4316	9.87664	84.2875	90.9937	3.0910E 05
32000	1.1516E 06	4.73314	40.7966	46.5189	9.87432	84.4175	91.1080	3.2682E 05
32500	1.1974E 06	4.72905	40.8291	46.6040	9.87140	84.5403	91.2184	3.4504E 05
33000	1.2444E 06	4.72482	40.8584	46.6879	9.86788	84.6561	91.3249	3.6376E 05
33500	1.2926E 06	4.72045	40.8846	46.7706	9.86376	84.7649	91.4274	3.8298E 05
34000	1.3420E 06	4.71594	40.9077	46.8521	9.85904	84.8667	91.5259	4.0270E 05
34500	1.3926E 06	4.71129	40.9277	46.9326	9.85372	84.9615	91.6194	4.2292E 05
35000	1.4444E 06	4.70650	40.9446	47.0071	9.84780	85.0493	91.7089	4.4364E 05
35500	1.4974E 06	4.70157	40.9584	47.0796	9.84128	85.1301	91.7934	4.6486E 05
36000	1.5516E 06	4.69650	40.9691	47.1501	9.83416	85.2039	91.8739	4.8658E 05
36500	1.6069E 06	4.69129	40.9767	47.2186	9.82644	85.2717	91.9494	5.0880E 05
37000	1.6634E 06	4.68594	40.9812	47.2851	9.81812	85.3335	92.0209	5.3152E 05
37500	1.7210E 06	4.68045	40.9827	47.3496	9.80920	85.3893	92.0874	5.5474E 05
38000	1.7797E 06	4.67482	40.9812	47.4121	9.80000	85.4391	92.1499	5.7846E 05
38500	1.8394E 06	4.66905	40.9767	47.4726	9.79052	85.4829	92.2074	6.0268E 05
39000	1.8999E 06	4.66314	40.9691	47.5311	9.78088	85.5207	92.2600	6.2740E 05
39500	1.9612E 06	4.65709	40.9584	47.5876	9.77108	85.5525	92.3075	6.5262E 05
40000	1.0211E 06	4.65090	40.9446	47.6421	9.76112	85.5783	92.3500	6.7834E 05

TABLE 90. IDEAL GAS FUNCTIONS FOR MO+ INMOLECULAR WEIGHT 30.0056, R = 1.98717 CAL/MOLE, 6 STATES INCLUDED

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2 E^2}{RT}$	$\frac{h^2 E^2}{RT} - \frac{h^2 E^2}{RT}$	$\frac{h^2 E^2}{RT}$	$\frac{h^2 E^2}{RT}$	$\frac{h^2 E^2}{RT}$	$\frac{h^2 E^2}{RT}$	$\frac{h^2 E^2}{RT}$	$\frac{h^2 E^2}{RT}$	$\frac{h^2 E^2}{RT}$	TEMP. (°K)
1000	3.6254E 02	3.62244	24.5996	28.2221	7.19039	48.8835	54.0819	5.2112E 03	7.1904E 03	1.9044E 03	1000
1200	4.4730E 02	3.68433	25.2656	28.9499	7.32137	50.2048	57.5282	6.4010E 03	8.7054E 03	2.8204E 03	1200
1400	5.3934E 02	3.74424	25.8300	29.5823	7.43443	51.3445	59.7849	7.4344E 03	1.0417E 04	3.7102E 03	1400
1600	6.3917E 02	3.79978	26.3417	30.1415	7.53080	52.3453	61.8961	8.3752E 03	1.2081E 04	4.6375E 03	1600
1800	7.4712E 02	3.85027	26.7922	30.6425	7.61111	53.2453	63.9617	9.2081E 03	1.3772E 04	5.5033E 03	1800
2000	8.6341E 02	3.89578	27.2003	31.0961	7.67156	54.0514	65.9930	1.0000E 04	1.5483E 04	6.3944E 03	2000
2200	9.8820E 02	3.93475	27.5735	31.5103	7.71623	54.7932	67.9932	1.0720E 04	1.7210E 04	7.2944E 03	2200
2400	1.1214E 03	3.96762	27.9177	31.8891	7.74623	55.4770	69.9642	1.1382E 04	1.8955E 04	8.2044E 03	2400
2600	1.2637E 03	4.00493	28.2317	32.2440	7.76243	56.1117	71.9042	1.2000E 04	2.0696E 04	9.1244E 03	2600
2800	1.4146E 03	4.03712	28.5351	32.5723	7.76623	56.7040	73.8142	1.2582E 04	2.2444E 04	1.0000E 04	2800
3000	1.5743E 03	4.06460	28.8146	32.8792	7.76043	57.2594	75.6942	1.3122E 04	2.4200E 04	1.0844E 04	3000
3200	1.7430E 03	4.08972	29.0778	33.1675	7.74623	57.7823	77.5442	1.3622E 04	2.5964E 04	1.1644E 04	3200
3400	1.9207E 03	4.11278	29.3244	33.4392	7.72443	58.2744	79.3642	1.4092E 04	2.7736E 04	1.2404E 04	3400
3600	2.1075E 03	4.13403	29.5621	33.6941	7.69623	58.7344	81.1642	1.4532E 04	2.9512E 04	1.3124E 04	3600
3800	2.3034E 03	4.15370	29.7861	33.9398	7.66243	59.1644	82.9442	1.4942E 04	3.1292E 04	1.3804E 04	3800
4000	2.5085E 03	4.17198	29.9997	34.1714	7.62443	59.5644	84.6942	1.5322E 04	3.3072E 04	1.4444E 04	4000
4200	2.7228E 03	4.18803	30.2036	34.3927	7.58043	60.0144	86.4142	1.5672E 04	3.4852E 04	1.5044E 04	4200
4400	2.9465E 03	4.20201	30.3989	34.6079	7.53243	60.4044	88.1042	1.6002E 04	3.6632E 04	1.5604E 04	4400
4600	3.1795E 03	4.22004	30.5781	34.8082	7.48043	60.7344	89.7642	1.6312E 04	3.8412E 04	1.6124E 04	4600
4800	3.4221E 03	4.23425	30.7460	35.0003	7.42443	61.1137	91.3942	1.6602E 04	4.0192E 04	1.6604E 04	4800
5000	3.6741E 03	4.24775	30.9392	35.1849	7.36443	61.4433	92.9942	1.6872E 04	4.1972E 04	1.7044E 04	5000
5200	3.9358E 03	4.26045	31.1060	35.3467	7.30043	61.8128	94.5642	1.7132E 04	4.3752E 04	1.7444E 04	5200
5400	4.2072E 03	4.27304	31.2671	35.5401	7.23243	62.1328	96.1042	1.7382E 04	4.5532E 04	1.7804E 04	5400
5600	4.4884E 03	4.28500	31.4227	35.7077	7.16043	62.4420	97.6142	1.7622E 04	4.7312E 04	1.8124E 04	5600
5800	4.7795E 03	4.29661	31.5732	35.8699	7.08443	62.7413	99.0942	1.7852E 04	4.9092E 04	1.8404E 04	5800
6000	5.0804E 03	4.30799	31.7191	36.0271	7.00443	63.0311	100.5442	1.8072E 04	5.0872E 04	1.8684E 04	6000
6200	5.3919E 03	4.31919	31.8605	36.1797	6.92043	63.3122	101.9642	1.8282E 04	5.2652E 04	1.8964E 04	6200
6400	5.7135E 03	4.33030	31.9978	36.3281	6.83243	63.5850	103.3542	1.8482E 04	5.4432E 04	1.9244E 04	6400
6600	6.0454E 03	4.34140	32.1313	36.4727	6.74043	63.8501	104.7142	1.8672E 04	5.6212E 04	1.9524E 04	6600
6800	6.3883E 03	4.35256	32.2610	36.6136	6.64426	64.1080	106.0442	1.8852E 04	5.7992E 04	1.9804E 04	6800
7000	6.7418E 03	4.36385	32.3874	36.7512	6.54443	64.3990	107.3442	1.9022E 04	5.9772E 04	2.0084E 04	7000
7200	7.1044E 03	4.37535	32.5105	36.8858	6.44043	64.6837	108.6142	1.9182E 04	6.1552E 04	2.0364E 04	7200
7400	7.4823E 03	4.38711	32.6305	37.0174	6.33243	64.9622	109.8642	1.9332E 04	6.3332E 04	2.0644E 04	7400
7600	7.8697E 03	4.39921	32.7477	37.1468	6.22043	65.2344	111.0942	1.9472E 04	6.5112E 04	2.0924E 04	7600
7800	8.2690E 03	4.41171	32.8621	37.2738	6.10443	65.5024	112.2942	1.9602E 04	6.6892E 04	2.1204E 04	7800
8000	8.6805E 03	4.42467	32.9739	37.3986	5.98443	65.7657	113.4642	1.9722E 04	6.8672E 04	2.1484E 04	8000
8200	9.1045E 03	4.43813	33.0834	37.5215	5.86043	66.0242	114.6142	1.9842E 04	7.0452E 04	2.1764E 04	8200
8400	9.5414E 03	4.45216	33.1905	37.6426	5.73243	66.2784	115.7442	1.9952E 04	7.2232E 04	2.2044E 04	8400
8600	9.9916E 03	4.46678	33.2954	37.7622	5.60043	66.5284	116.8542	2.0062E 04	7.4012E 04	2.2324E 04	8600
8800	1.0456E 04	4.48206	33.3983	37.8803	5.46443	66.7744	117.9442	2.0162E 04	7.5792E 04	2.2604E 04	8800
9000	1.0934E 04	4.49801	33.4992	37.9972	5.32443	66.9944	119.0142	2.0252E 04	7.7572E 04	2.2884E 04	9000
9200	1.1427E 04	4.51468	33.5982	38.1129	5.18043	67.2084	120.0642	2.0342E 04	7.9352E 04	2.3164E 04	9200
9400	1.1935E 04	4.53207	33.6955	38.2276	5.03243	67.4184	121.0942	2.0432E 04	8.1132E 04	2.3444E 04	9400
9600	1.2459E 04	4.55021	33.7911	38.3413	4.88043	67.6244	122.1042	2.0522E 04	8.2912E 04	2.3724E 04	9600
9800	1.2999E 04	4.56912	33.8851	38.4542	4.72443	67.8264	123.0942	2.0612E 04	8.4692E 04	2.4004E 04	9800

TABLE 90 (CONT.). IDEAL GAS FUNCTIONS FOR NO.

TEMP. (°K)	PARTIT. FUNCT.	$\frac{H^\circ - G^\circ}{RT}$	$\frac{H^\circ - G^\circ}{RT}$	$\frac{H^\circ - G^\circ}{RT}$	$\frac{H^\circ - G^\circ}{RT}$	$\frac{H^\circ - G^\circ}{RT}$	$\frac{H^\circ - G^\circ}{RT}$	$\frac{H^\circ - G^\circ}{RT}$	$\frac{H^\circ - G^\circ}{RT}$	$\frac{H^\circ - G^\circ}{RT}$	$\frac{H^\circ - G^\circ}{RT}$	TEMP. (°K)
10000	1.3557E 04	4.50879	33.9776	38.5664	9.11668	67.5192	76.6378	7.1315E 04	9.1107E 04	1.1070E 04	6.7319E 05	10000
10500	1.5630E 04	4.64126	34.2028	38.8440	9.22294	77.1895	77.1895	7.1345E 04	9.0641E 04	1.0277E 05	7.5236E 05	10500
11000	1.6626E 04	4.69822	34.4207	39.1182	9.33413	68.3902	77.3343	8.0839E 04	1.0277E 05	1.0277E 05	7.5236E 05	11000
11500	1.8357E 04	4.75918	34.6302	39.3893	9.45728	68.8158	78.2721	8.5904E 04	1.0877E 05	1.0877E 05	7.9136E 05	11500
12000	2.0237E 04	4.82363	34.8340	39.6575	9.58496	69.2210	78.8060	9.1174E 04	1.1502E 05	1.1502E 05	8.3065E 05	12000
12500	2.2280E 04	4.89010	35.0323	39.9224	9.71744	69.6150	79.3324	9.6628E 04	1.2157E 05	1.2157E 05	8.7019E 05	12500
13000	2.4503E 04	4.95818	35.2234	40.1834	9.85272	69.9997	79.8514	1.0229E 05	1.2839E 05	1.2839E 05	9.1000E 05	13000
13500	2.6919E 04	5.02661	35.4138	40.4404	9.98871	70.3731	80.3618	1.0802E 05	1.3542E 05	1.3542E 05	9.5004E 05	13500
14000	2.9546E 04	5.09435	35.5979	40.6922	10.12331	70.7368	80.8621	1.1391E 05	1.4173E 05	1.4173E 05	9.9034E 05	14000
14500	3.2400E 04	5.16038	35.7778	40.9382	10.25453	71.0964	81.3509	1.1980E 05	1.4869E 05	1.4869E 05	1.0309E 06	14500
15000	3.5496E 04	5.22380	35.9538	41.1776	10.38056	71.4462	81.8267	1.2590E 05	1.5571E 05	1.5571E 05	1.0717E 06	15000
15500	3.8850E 04	5.28382	36.1261	41.4099	10.50083	71.7885	82.2883	1.3195E 05	1.6273E 05	1.6273E 05	1.1127E 06	15500
16000	4.2478E 04	5.33981	36.2967	41.6345	10.61610	72.1236	82.7367	1.3798E 05	1.6978E 05	1.6978E 05	1.1540E 06	16000
16500	4.6399E 04	5.39125	36.4648	41.8511	10.71331	72.4517	83.1651	1.4398E 05	1.7677E 05	1.7677E 05	1.1951E 06	16500
17000	5.0613E 04	5.43783	36.6215	42.0593	10.80586	72.7750	83.5786	1.4992E 05	1.8370E 05	1.8370E 05	1.2371E 06	17000
17500	5.5143E 04	5.47931	36.7767	42.2590	10.88829	73.0874	83.9757	1.5577E 05	1.9059E 05	1.9059E 05	1.2790E 06	17500
18000	6.0003E 04	5.51562	36.9346	42.4502	10.96044	73.3922	84.3556	1.6152E 05	1.9729E 05	1.9729E 05	1.3211E 06	18000
18500	6.5201E 04	5.54676	37.0862	42.6329	11.02233	73.6964	84.7187	1.6715E 05	2.0391E 05	2.0391E 05	1.3634E 06	18500
19000	7.0746E 04	5.57286	37.2345	42.8073	11.07619	73.9910	85.0652	1.7265E 05	2.1041E 05	2.1041E 05	1.4058E 06	19000
19500	7.6646E 04	5.59407	37.3795	42.9736	11.11634	74.2792	85.3956	1.7802E 05	2.1677E 05	2.1677E 05	1.4486E 06	19500
20000	8.2909E 04	5.61063	37.5213	43.1320	11.14925	74.5611	85.7104	1.8324E 05	2.2299E 05	2.2299E 05	1.4912E 06	20000
20500	1.1171E 05	5.63589	38.0578	43.6936	11.19944	75.4271	86.0265	2.0267E 05	2.4439E 05	2.4439E 05	1.6630E 06	20500
21000	1.4663E 05	5.66980	38.5473	44.1571	11.14759	76.5999	87.1475	2.1895E 05	2.6754E 05	2.6754E 05	1.8304E 06	21000
21500	1.8766E 05	5.69647	38.9942	44.5438	11.02810	77.4878	88.3159	2.3504E 05	2.8673E 05	2.8673E 05	2.0107E 06	21500
22000	2.3458E 05	5.74688	39.4026	44.8714	10.86757	78.2994	89.1670	2.4865E 05	3.0429E 05	3.0429E 05	2.1924E 06	22000
22500	2.8701E 05	5.77684	39.7768	45.1536	10.68468	79.0430	89.7277	2.6093E 05	3.2054E 05	3.2054E 05	2.3713E 06	22500
23000	3.4451E 05	5.79981	40.1207	45.4005	10.49186	79.7265	90.2184	2.7215E 05	3.3574E 05	3.3574E 05	2.5512E 06	23000
23500	4.0455E 05	5.81180	40.4379	45.6197	10.29709	80.3567	90.6538	2.8254E 05	3.5010E 05	3.5010E 05	2.7321E 06	23500
24000	4.7268E 05	5.82529	40.7313	45.8166	10.10531	80.9398	91.0451	2.9225E 05	3.6378E 05	3.6378E 05	2.9138E 06	24000
24500	5.4213E 05	5.839177	41.0037	45.9955	9.91947	81.4812	91.4007	3.0153E 05	3.7694E 05	3.7694E 05	3.0963E 06	24500
40000	6.1463E 05	4.90206	41.2575	46.1535	9.74117	81.9854	91.7266	3.1016E 05	3.8965E 05	3.8965E 05	3.2794E 06	40000

TABLE 91. IDEAL GAS FUNCTIONS FOR O<sub>2</sub> - MOLECULAR WEIGHT 31.9994, R = 1.98717 CAL/MOLE, 1 STATES INCLUDED

TEMP. (°K)	PARTIT. FUNCT.	$\frac{H^0 - E^0}{RT}$	$-\frac{E^0 - E^0}{RT}$	$S^0/R$	$\ln \frac{W^0 - E^0}{W^0 - E^0} - \frac{E^0 - E^0}{RT}$	$S^0$	$E^0 - E^0$	$\frac{H^0 - E^0}{\text{CAL/MOLE}}$	$-(E^0 - E^0)$	TEMP. (°K)
1000	1.4789E 03	3.90526	26.1021	30.0073	7.76040	51.8691	59.6295	5.7732E 03	7.7604E 03	5.1869E 04
1200	1.9246E 03	3.98363	24.0213	30.8049	7.91613	53.2983	61.2144	7.1148E 03	9.4994E 03	6.3950E 04
1400	2.4312E 03	4.04760	22.4403	31.4879	8.04326	54.9284	62.5717	8.4785E 03	1.1261E 04	7.6330E 04
1600	2.9999E 03	4.10065	20.9844	32.0880	8.14866	56.6096	63.7582	9.8584E 03	1.3032E 04	8.8975E 04
1800	3.6320E 03	4.14538	20.4700	32.6154	8.23755	58.2746	64.8122	1.1251E 04	1.4828E 04	1.0163E 05
2000	4.3382E 03	4.18346	20.0088	33.0924	8.31362	59.9445	65.7602	1.2453E 04	1.6627E 04	1.1449E 05
2200	5.0897E 03	4.21679	19.5991	33.5259	8.37945	61.6215	66.6215	1.4053E 04	1.8435E 04	1.2813E 05
2400	5.9172E 03	4.24569	19.2473	33.9230	8.43689	63.3737	67.4106	1.5479E 04	2.0249E 04	1.4154E 05
2600	6.8116E 03	4.27102	30.0182	34.2892	8.48721	65.1111	68.1383	1.6900E 04	2.2067E 04	1.5509E 05
2800	7.7733E 03	4.29327	30.3355	34.6268	8.53144	66.8217	68.8131	1.8324E 04	2.3888E 04	1.6879E 05
3000	8.8031E 03	4.31281	30.6324	34.9432	8.57027	68.5716	69.4419	1.9749E 04	2.5711E 04	1.8261E 05
3200	9.9012E 03	4.32984	30.9113	35.2412	8.60431	70.3032	70.0302	2.1175E 04	2.7534E 04	1.9650E 05
3400	1.1048E 04	4.34493	31.1743	35.5192	8.63409	72.0585	70.5825	2.2600E 04	2.9356E 04	2.1062E 05
3600	1.2204E 04	4.35800	31.4250	35.7810	8.66004	73.8227	71.1027	2.4022E 04	3.1176E 04	2.2479E 05
3800	1.3388E 04	4.36934	31.6589	36.0283	8.68261	75.5941	71.5941	2.5443E 04	3.2994E 04	2.3906E 05
4000	1.4581E 04	4.37914	31.8833	36.2424	8.70208	77.3574	72.0595	2.6860E 04	3.4808E 04	2.5343E 05
4200	1.5783E 04	4.38754	32.0972	36.4837	8.71877	79.1224	72.5012	2.8273E 04	3.6619E 04	2.6789E 05
4400	1.6994E 04	4.39467	32.3014	36.6951	8.73294	80.8879	72.9213	2.9681E 04	3.8425E 04	2.8243E 05
4600	1.8212E 04	4.40063	32.4969	36.8976	8.74479	82.6479	73.3216	3.1085E 04	4.0226E 04	2.9705E 05
4800	1.9438E 04	4.40551	32.6843	37.0898	8.75449	84.4042	73.7037	3.2483E 04	4.2022E 04	3.1176E 05
5000	2.0672E 04	4.40938	32.8643	37.2736	8.76217	86.1567	74.0689	3.3875E 04	4.3811E 04	3.2653E 05
5200	2.1912E 04	4.41230	33.0373	37.4496	8.76794	87.9055	74.4185	3.5260E 04	4.5593E 04	3.4138E 05
5400	2.3158E 04	4.41431	33.2038	37.6181	8.77133	89.6504	74.7534	3.6638E 04	4.7369E 04	3.5630E 05
5600	2.4409E 04	4.41545	33.3644	37.7798	8.77243	91.3915	75.0748	3.8008E 04	4.9136E 04	3.7128E 05
5800	2.5664E 04	4.41576	33.5193	37.9351	8.77148	93.1285	75.3833	3.9369E 04	5.0894E 04	3.8633E 05
6000	2.6923E 04	4.41526	33.6690	38.0853	8.77009	94.8619	75.6798	4.0720E 04	5.2643E 04	4.0144E 05
6200	2.8182E 04	4.41399	33.8138	38.2278	8.76732	96.5924	75.9649	4.2082E 04	5.4382E 04	4.1660E 05
6400	2.9441E 04	4.41197	33.9539	38.3659	8.76332	98.3197	76.2393	4.3433E 04	5.6111E 04	4.3182E 05
6600	3.0697E 04	4.40923	34.0894	38.4988	8.75817	100.0436	76.5036	4.4713E 04	5.7828E 04	4.4710E 05
6800	3.1957E 04	4.40579	34.2212	38.6270	8.75204	101.7682	76.7582	4.6022E 04	5.9534E 04	4.6242E 05
7000	3.3214E 04	4.40168	34.3489	38.7505	8.74487	103.4931	77.0037	4.7318E 04	6.1228E 04	4.7780E 05
7200	3.4468E 04	4.39694	34.4728	38.8697	8.73744	105.2184	77.2406	4.8602E 04	6.2915E 04	4.9322E 05
7400	3.5715E 04	4.39158	34.5932	38.9848	8.72879	106.9436	77.4692	4.9873E 04	6.4578E 04	5.0869E 05
7600	3.6956E 04	4.38564	34.7102	39.0959	8.71899	108.6688	77.6899	5.1131E 04	6.6234E 04	5.2421E 05
7800	3.8186E 04	4.37915	34.8241	39.2032	8.70810	110.3941	77.9033	5.2376E 04	6.7876E 04	5.3977E 05
8000	3.9407E 04	4.37214	34.9348	39.3070	8.69617	112.1194	78.1095	5.3603E 04	6.9505E 04	5.5537E 05
8200	4.0615E 04	4.36465	35.0427	39.4074	8.68328	113.8446	78.3089	5.4826E 04	7.1121E 04	5.7101E 05
8400	4.1812E 04	4.35670	35.1478	39.5045	8.66948	115.5697	78.5020	5.6031E 04	7.2723E 04	5.8669E 05
8600	4.3000E 04	4.34832	35.2502	39.5985	8.65484	117.2948	78.6888	5.7222E 04	7.4311E 04	6.0241E 05
8800	4.4179E 04	4.33955	35.3501	39.6896	8.64034	119.0199	78.8699	5.8399E 04	7.5886E 04	6.1817E 05
9000	4.5349E 04	4.33042	35.4475	39.7779	8.62526	120.7450	79.0453	5.9533E 04	7.7447E 04	6.3386E 05
9200	4.6509E 04	4.32095	35.5424	39.8635	8.60965	122.4701	79.2154	6.0713E 04	7.8995E 04	6.4979E 05
9400	4.7659E 04	4.31118	35.6354	39.9466	8.59365	124.1952	79.3804	6.1853E 04	8.0530E 04	6.6565E 05
9600	4.8809E 04	4.30113	35.7261	40.0272	8.57705	125.9203	79.5404	6.2953E 04	8.2052E 04	6.8156E 05
9800	4.9959E 04	4.29083	35.8146	40.1055	8.56005	127.6454	79.6962	6.4066E 04	8.3560E 04	6.9746E 05

TABLE 91 (CONT.). IDEAL GAS FUNCTIONS FOR O<sub>2</sub>

TEMP. (°K)	PARTIT. FUNCT.	$\frac{W}{RT}$	$-\frac{F^0 - F}{RT}$	$\ln$	$W^0 - F^0_{CAL}$	$-\ln \frac{F^0 - F}{W}$	$F^0 - F$	$W^0 - F^0_{CAL}$	$-\ln \frac{F^0 - F}{W}$	TEMP. (°K)
1000	8.4267E 04	4.20030	39.9012	40.1819	0.50566	71.3416	70.0473	0.51056	0.5057E 04	10000
1050	9.1853E 04	4.25314	36.1094	40.3625	0.45169	71.7553	69.2070	0.7870E 04	0.8742E 05	10500
1100	9.9594E 04	4.22507	34.3064	40.5317	0.39591	72.1672	66.5431	7.0440E 04	7.9562E 05	11000
1150	1.0744E 05	4.19430	34.4030	40.6902	0.33890	72.5192	63.8501	7.3045E 04	9.597E 04	11500
1200	1.1544E 05	4.16733	34.6718	40.8391	0.28117	72.8729	61.1540	7.5323E 04	9.9374E 04	12000
1250	1.2350E 05	4.14013	34.9413	40.9794	0.22315	73.2097	58.4339	7.7950E 04	1.0279E 05	12500
1300	1.3162E 05	4.10997	37.0030	41.1120	0.16519	73.5311	55.6943	8.0314E 04	1.0615E 05	13000
1350	1.3970E 05	4.07990	37.1375	41.2375	0.10759	73.8382	52.9456	8.2620E 04	1.0945E 05	13500
1400	1.4787E 05	4.05126	37.3054	41.3567	0.05037	74.1320	50.1826	8.4880E 04	1.1271E 05	14000
1450	1.5617E 05	4.02298	37.4471	41.4701	7.99432	74.4135	47.4078	8.7104E 04	1.1592E 05	14500
1500	1.6437E 05	3.99514	37.5630	41.5781	7.93099	74.6836	44.6236	8.9277E 04	1.1908E 05	15000
1550	1.7259E 05	3.96781	37.7135	41.6813	7.86449	74.9430	41.8277	9.1412E 04	1.2221E 05	15500
1600	1.8070E 05	3.94104	37.8391	41.7791	7.83150	75.1925	39.0240	9.3509E 04	1.2530E 05	16000
1650	1.8882E 05	3.91406	37.9486	41.8740	7.77940	75.4327	36.2122	9.5573E 04	1.2836E 05	16500
1700	1.9690E 05	3.88930	38.0764	41.9657	7.72060	75.6642	33.3929	9.7604E 04	1.3139E 05	17000
1750	2.0491E 05	3.86435	38.1888	42.0532	1.67911	75.8875	30.5664	9.9609E 04	1.3438E 05	17500
1800	2.1286E 05	3.84004	38.2973	42.1374	7.63070	76.1032	27.7359	1.0159E 05	1.3735E 05	18000
1850	2.2075E 05	3.81635	38.4022	42.2186	7.58371	76.3116	24.8953	1.0354E 05	1.4030E 05	18500
1900	2.2857E 05	3.79329	38.5037	42.2970	7.53709	76.5132	22.0511	1.0544E 05	1.4322E 05	19000
1950	2.3631E 05	3.77064	38.6019	42.3728	7.49329	76.7084	19.2017	1.0737E 05	1.4612E 05	19500
2000	2.4397E 05	3.74901	38.6971	42.4461	7.44991	76.8976	16.3475	1.0925E 05	1.4900E 05	20000
2050	2.5157E 05	3.72754	38.7894	42.5181	7.40600	77.0800	13.4879	1.1114E 05	1.5184E 05	20500
2100	2.5913E 05	3.70623	38.8788	42.5882	7.36132	77.2557	10.6277	1.1305E 05	1.5465E 05	21000
2150	2.6665E 05	3.68509	38.9651	42.6574	7.31688	77.4343	7.7643	1.1496E 05	1.5744E 05	21500
2200	2.7414E 05	3.66416	39.0487	42.7258	7.27279	77.6060	4.8990	1.1686E 05	1.6021E 05	22000
2250	2.8160E 05	3.64341	39.1297	42.7933	7.22896	77.7721	2.0344	1.1875E 05	1.6296E 05	22500
2300	2.8903E 05	3.62283	39.2081	42.8600	7.18539	77.9326	-0.8309	1.2063E 05	1.6569E 05	23000
2350	2.9644E 05	3.60242	39.2840	42.9259	7.14208	78.0876	-3.6876	1.2250E 05	1.6840E 05	23500
2400	3.0383E 05	3.58216	39.3574	42.9910	7.09892	78.2371	-6.5444	1.2436E 05	1.7109E 05	24000
2450	3.1120E 05	3.56204	39.4284	43.0553	7.05591	78.3811	-9.4011	1.2621E 05	1.7376E 05	24500
2500	3.1855E 05	3.54206	39.4969	43.1190	7.01305	78.5200	-12.2576	1.2806E 05	1.7641E 05	25000
2550	3.2589E 05	3.52222	39.5630	43.1822	6.97034	78.6540	-15.1144	1.2990E 05	1.7905E 05	25500
2600	3.3321E 05	3.50251	39.6276	43.2450	6.92779	78.7930	-17.9711	1.3173E 05	1.8168E 05	26000
2650	3.4052E 05	3.48292	39.6907	43.3074	6.88539	78.9271	-20.8276	1.3356E 05	1.8430E 05	26500
2700	3.4782E 05	3.46345	39.7523	43.3694	6.84314	79.0564	-23.6844	1.3538E 05	1.8691E 05	27000
2750	3.5511E 05	3.44410	39.8124	43.4310	6.80104	79.1811	-26.5411	1.3719E 05	1.8951E 05	27500
2800	3.6239E 05	3.42486	39.8711	43.4922	6.75909	79.3011	-29.3976	1.3900E 05	1.9210E 05	28000
2850	3.6966E 05	3.40572	39.9284	43.5530	6.71729	79.4164	-32.2544	1.4080E 05	1.9468E 05	28500
2900	3.7692E 05	3.38668	39.9843	43.6134	6.67564	79.5271	-35.1111	1.4259E 05	1.9725E 05	29000
2950	3.8417E 05	3.36774	39.9990	43.6734	6.63414	79.6331	-37.9676	1.4437E 05	1.9981E 05	29500
3000	3.9141E 05	3.34890	39.9630	43.7330	6.59279	79.7344	-40.8244	1.4615E 05	2.0236E 05	30000
3050	3.9864E 05	3.33016	39.9254	43.7922	6.55159	79.8311	-43.6811	1.4792E 05	2.0490E 05	30500
3100	4.0587E 05	3.31151	39.8870	43.8510	6.51044	79.9231	-46.5376	1.4969E 05	2.0743E 05	31000
3150	4.1309E 05	3.29296	39.8477	43.9094	6.46934	80.0111	-49.3944	1.5145E 05	2.0995E 05	31500
3200	4.2030E 05	3.27451	39.8074	43.9674	6.42829	80.0954	-52.2511	1.5321E 05	2.1246E 05	32000
3250	4.2751E 05	3.25616	39.7661	44.0250	6.38729	80.1754	-55.1076	1.5496E 05	2.1496E 05	32500
3300	4.3472E 05	3.23791	39.7237	44.0822	6.34634	80.2511	-57.9644	1.5671E 05	2.1746E 05	33000
3350	4.4192E 05	3.21976	39.6804	44.1390	6.30544	80.3231	-60.8211	1.5846E 05	2.1995E 05	33500
3400	4.4912E 05	3.20171	39.6361	44.1954	6.26459	80.3911	-63.6776	1.6021E 05	2.2243E 05	34000
3450	4.5632E 05	3.18376	39.5917	44.2514	6.22379	80.4554	-66.5344	1.6196E 05	2.2490E 05	34500
3500	4.6352E 05	3.16591	39.5464	44.3070	6.18304	80.5154	-69.3911	1.6371E 05	2.2736E 05	35000
3550	4.7072E 05	3.14816	39.5001	44.3622	6.14229	80.5711	-72.2476	1.6546E 05	2.2981E 05	35500
3600	4.7792E 05	3.13051	39.4527	44.4174	6.10159	80.6231	-75.1044	1.6721E 05	2.3226E 05	36000
3650	4.8512E 05	3.11296	39.4054	44.4722	6.06084	80.6754	-77.9611	1.6896E 05	2.3471E 05	36500
3700	4.9232E 05	3.09551	39.3570	44.5270	6.02009	80.7231	-80.8176	1.7071E 05	2.3716E 05	37000
3750	4.9952E 05	3.07806	39.3087	44.5814	5.97929	80.7711	-83.6744	1.7246E 05	2.3961E 05	37500
3800	5.0672E 05	3.06071	39.2594	44.6354	5.93849	80.8154	-86.5311	1.7421E 05	2.4206E 05	38000
3850	5.1392E 05	3.04346	39.2091	44.6890	5.89769	80.8554	-89.3876	1.7596E 05	2.4451E 05	38500
3900	5.2112E 05	3.02621	39.1587	44.7422	5.85689	80.8911	-92.2444	1.7771E 05	2.4696E 05	39000
3950	5.2832E 05	3.00906	39.1074	44.7950	5.81609	80.9231	-95.1011	1.7946E 05	2.4941E 05	39500
4000	5.3552E 05	3.00181	39.0551	44.8474	5.77529	80.9511	-97.9576	1.8121E 05	2.5186E 05	40000

TABLE 92. IDEAL GAS FUNCTIONS FOR O<sub>2</sub> (MOLECULAR WEIGHT 31.9988, R = 1.98717 CAL/MOLE, 7 STATES INCLUDED)

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2-E_0}{RT}$	$-\frac{F^0-E^0}{RT}$	$\frac{S^0}{R}$	$(h^2-E_0)VT - (F^0-E^0)VT_0 - \frac{S^0}{R}$	$E^0-E_0$ -- CAL/MOLE --	$h^2-E_0$ -- CAL/MOLE --	TEMP. (°K)
1000	5.1641E 02	3.77504	25.5079	29.2829	7.50164	50.4884	5.5149E 03	5.0648E 04
1200	1.0374E 03	3.65341	26.2033	30.0567	7.55137	52.0702	6.8042E 03	6.2484E 04
1400	1.2848E 03	3.52139	26.8025	30.7239	7.59261	53.2610	8.1776E 03	7.4545E 04
1600	1.5595E 03	3.39088	27.3301	31.3110	7.61067	54.3094	9.4774E 03	8.6895E 04
1800	1.8624E 03	3.26389	27.8021	31.8360	7.61601	55.2473	1.0852E 04	9.9443E 04
2000	2.1947E 03	3.14208	28.2296	32.3117	7.61177	56.0949	1.2249E 04	1.1219E 05
2200	2.5573E 03	3.02665	28.6208	32.7475	7.60034	56.8743	1.3649E 04	1.2512E 05
2400	2.9514E 03	2.91683	28.9817	33.1501	7.58336	57.5934	1.5111E 04	1.3822E 05
2600	3.3764E 03	2.81298	29.3169	33.5249	7.56195	58.2619	1.6574E 04	1.5147E 05
2800	3.8396E 03	2.71564	29.6301	33.8758	7.53678	58.8960	1.8039E 04	1.6486E 05
3000	4.3344E 03	2.62431	29.9243	34.2059	7.50831	59.4645	1.9503E 04	1.7839E 05
3200	4.8702E 03	2.53812	30.2017	34.5179	7.47685	60.0159	2.1078E 04	1.9205E 05
3400	5.4425E 03	2.45620	30.4644	34.8136	7.44259	60.5374	2.2682E 04	2.0583E 05
3600	6.0547E 03	2.37895	30.7139	35.0949	7.40567	61.0336	2.4317E 04	2.1972E 05
3800	6.7043E 03	2.30516	30.9516	35.3630	7.36621	61.5059	2.5976E 04	2.3372E 05
4000	7.3949E 03	2.23465	31.1786	35.6193	7.32430	61.9571	2.7659E 04	2.4783E 05
4200	8.1289E 03	2.16718	31.3960	35.8647	7.28003	62.3890	2.9364E 04	2.6203E 05
4400	8.9072E 03	2.10245	31.6045	36.1001	7.23436	62.8033	3.1090E 04	2.7633E 05
4600	9.7309E 03	2.04017	31.8049	36.3262	7.18739	63.2016	3.2836E 04	2.9073E 05
4800	1.0600E 04	1.98005	31.9978	36.5439	7.13914	63.5850	3.4594E 04	3.0521E 05
5000	1.1583E 04	1.92183	32.1839	36.7535	7.08963	63.9547	3.6367E 04	3.1977E 05
5200	1.2568E 04	1.86549	32.3636	36.9537	7.03903	64.3117	3.8152E 04	3.3442E 05
5400	1.3607E 04	1.81105	32.5373	37.1509	6.98737	64.6570	3.9948E 04	3.4915E 05
5600	1.4699E 04	1.75840	32.7054	37.3393	6.93467	64.9911	4.1756E 04	3.6395E 05
5800	1.5848E 04	1.70743	32.8684	37.5218	6.88099	65.3149	4.3584E 04	3.7883E 05
6000	1.7053E 04	1.65817	33.0265	37.6980	6.82636	65.6290	4.5432E 04	3.9377E 05
6200	1.8317E 04	1.61053	33.1799	37.8686	6.77176	65.9340	4.7300E 04	4.0879E 05
6400	1.9640E 04	1.56453	33.3290	38.0337	6.71724	66.2303	4.9187E 04	4.2387E 05
6600	2.1023E 04	1.51915	33.4740	38.1935	6.66283	66.5189	5.1092E 04	4.3902E 05
6800	2.2468E 04	1.47531	33.6151	38.3482	6.60847	66.7998	5.3014E 04	4.5423E 05
7000	2.3975E 04	1.43295	33.7525	38.4981	6.55428	67.0718	5.4952E 04	4.6950E 05
7200	2.5545E 04	1.39204	33.8864	38.6433	6.50027	67.3378	5.6906E 04	4.8483E 05
7400	2.7176E 04	1.35253	34.0168	38.7839	6.44646	67.5971	5.8876E 04	5.0022E 05
7600	2.8875E 04	1.31441	34.1441	38.9201	6.39283	67.8500	6.0860E 04	5.1564E 05
7800	3.0637E 04	1.27766	34.2683	39.0520	6.33937	68.0967	6.2866E 04	5.3115E 05
8000	3.2464E 04	1.24230	34.3895	39.1799	6.28607	68.3375	6.4884E 04	5.4670E 05
8200	3.4355E 04	1.20823	34.5078	39.3037	6.23292	68.5727	6.6915E 04	5.6230E 05
8400	3.6311E 04	1.17536	34.6234	39.4237	6.17991	68.8025	6.8960E 04	5.7794E 05
8600	3.8332E 04	1.14364	34.7364	39.5401	6.12695	69.0270	7.1019E 04	5.9363E 05
8800	4.0418E 04	1.11307	34.8469	39.6528	6.07404	69.2465	7.3064E 04	6.0937E 05
9000	4.2569E 04	1.08364	34.9549	39.7621	6.02118	69.4612	7.5120E 04	6.2515E 05
9200	4.4783E 04	1.05536	35.0606	39.8680	5.96837	69.6712	7.7186E 04	6.4097E 05
9400	4.7061E 04	1.02813	35.1640	39.9707	5.91561	69.8766	7.9262E 04	6.5684E 05
9600	4.9402E 04	1.00195	35.2651	40.0704	5.86290	70.0777	8.1348E 04	6.7275E 05
9800	5.1806E 04	0.97682	35.3642	40.1670	5.81024	70.2765	8.3444E 04	6.8869E 05

TABLE 92 (CONT.). IDEAL GAS FUNCTIONS FOR O<sub>2</sub>

TEMP. (°K)	PARTIAL- FUNCT.	$\frac{h^0 - E^0}{RT}$	$\frac{h^0 - E^0}{RT} - \frac{F^0 - E^0}{RT}$	$\frac{h^0 - E^0}{RT}$	$\frac{h^0 - E^0}{RT}$	$\frac{h^0 - E^0}{RT}$	$\frac{h^0 - E^0}{RT}$	$\frac{h^0 - E^0}{RT}$	$\frac{h^0 - E^0}{RT}$	$\frac{h^0 - E^0}{RT}$	TEMP. (°K)
10000	5.4271E 04	4.79963	35.4612	40.2408	9.33765	70.4673	80.0049	1.9902E 04	9.5374E 04	7.0447E 05	10000
10500	6.0700E 04	4.77835	35.6551	40.4835	9.31523	70.3321	80.4473	7.9045E 04	9.4910E 04	7.0447E 05	10500
11000	6.7495E 04	4.75725	35.9175	40.6905	9.29444	71.3761	80.8907	8.2612E 04	9.4433E 05	7.0447E 05	11000
11500	7.4640E 04	4.73606	36.1293	40.8933	9.27371	71.7449	81.2620	8.5789E 04	1.0084E 05	8.2364E 05	11500
12000	8.2118E 04	4.71527	36.3312	41.0834	9.25300	72.1960	81.5946	8.9000E 04	1.1283E 05	8.6633E 05	12000
12500	8.9909E 04	4.70811	36.5239	41.2320	9.23579	72.5789	81.9347	9.2108E 04	1.1699E 05	9.0724E 05	12500
13000	9.7994E 04	4.68205	36.7080	41.3901	9.20401	72.9449	82.2489	9.5119E 04	1.2045E 05	9.4828E 05	13000
13500	1.0635E 05	4.65452	36.8842	41.5387	9.24930	73.2950	82.5443	9.8039E 04	1.2448E 05	9.8948E 05	13500
14000	1.1496E 05	4.62587	37.0530	41.6788	9.19237	73.5304	82.8227	1.0037E 05	1.2866E 05	1.0308E 06	14000
14500	1.2380E 05	4.59641	37.2146	41.8112	9.13383	73.9519	83.0857	1.0363E 05	1.3244E 05	1.0723E 06	14500
15000	1.3289E 05	4.56640	37.3701	41.9345	9.07420	74.2605	83.3347	1.0631E 05	1.3611E 05	1.1139E 06	15000
15500	1.4209E 05	4.53607	37.5193	42.0554	9.01392	74.5571	83.5710	1.0891E 05	1.3972E 05	1.1554E 06	15500
16000	1.5151E 05	4.50559	37.6629	42.1685	8.95354	74.8423	83.7957	1.1146E 05	1.4325E 05	1.1975E 06	16000
16500	1.6108E 05	4.47512	37.8010	42.2762	8.89281	75.1149	84.0097	1.1394E 05	1.4673E 05	1.2394E 06	16500
17000	1.7079E 05	4.44479	37.9342	42.3790	8.83254	75.3815	84.2140	1.1637E 05	1.5015E 05	1.2815E 06	17000
17500	1.8061E 05	4.41470	38.0626	42.4773	8.77276	75.6367	84.4094	1.1875E 05	1.5352E 05	1.3234E 06	17500
18000	1.9054E 05	4.38493	38.1865	42.5715	8.71359	75.8830	84.5945	1.2108E 05	1.5684E 05	1.3659E 06	18000
18500	2.0054E 05	4.35536	38.3063	42.6618	8.65521	76.1209	84.7761	1.2334E 05	1.6012E 05	1.4082E 06	18500
19000	2.1065E 05	4.32662	38.4220	42.7487	8.59771	76.3510	84.9487	1.2560E 05	1.6336E 05	1.4507E 06	19000
19500	2.2081E 05	4.29817	38.5341	42.8322	8.54117	76.5735	85.1147	1.2780E 05	1.6655E 05	1.4932E 06	19500
20000	2.3101E 05	4.27023	38.6425	42.9128	8.48505	76.7891	85.2747	1.2997E 05	1.6971E 05	1.5358E 06	20000
22000	2.7209E 05	4.16399	39.0445	43.2085	8.27454	77.5878	85.8624	1.3832E 05	1.8204E 05	1.7069E 06	22000
24000	3.1131E 05	4.06683	39.4026	43.4494	8.08156	78.2994	86.3808	1.4626E 05	1.9394E 05	1.8792E 06	24000
26000	3.5374E 05	3.97847	39.7245	43.7030	7.90587	78.9392	86.8451	1.5389E 05	2.0555E 05	2.0524E 06	26000
28000	3.9352E 05	3.89825	40.0164	43.9146	7.74646	79.5192	87.2654	1.6126E 05	2.1690E 05	2.2265E 06	28000
30000	4.3228E 05	3.82540	40.2828	44.1082	7.60171	80.0486	87.6503	1.6844E 05	2.2805E 05	2.4015E 06	30000
32000	4.6988E 05	3.75914	40.5276	44.2867	7.47004	80.5350	88.0050	1.7545E 05	2.3904E 05	2.5771E 06	32000
34000	5.0642E 05	3.69875	40.7536	44.4524	7.35002	80.9842	88.3342	1.8234E 05	2.4990E 05	2.7535E 06	34000
36000	5.4127E 05	3.64355	40.9634	44.6070	7.24034	81.4011	88.6415	1.8911E 05	2.6045E 05	2.9304E 06	36000
38000	5.7500E 05	3.59297	41.1591	44.7520	7.13982	81.7899	88.9297	1.9580E 05	2.7131E 05	3.1080E 06	38000
40000	6.0743E 05	3.54648	41.3422	44.8887	7.04744	82.1537	89.2012	2.0241E 05	2.8190E 05	3.2861E 06	40000

TABLE 93. IDEAL GAS FUNCTIONS FOR O<sub>2</sub>. MOLECULAR WEIGHT 31.9983, R = 1.98717 CAL/MOLE, 4 STATES INCLUDED

TEMP. (°K)	PARTIT. FUNCT.	$\frac{H^0 - E_0^0}{RT}$	$\frac{S^0}{R}$	$\ln \frac{H^0 - E_0^0}{RT} - \frac{S^0}{R}$	$\frac{H^0 - E_0^0}{RT} - \frac{S^0}{R}$	$\frac{H^0 - E_0^0}{RT} - \frac{S^0}{R}$	$\frac{H^0 - E_0^0}{RT} - \frac{S^0}{R}$	$\frac{H^0 - E_0^0}{RT} - \frac{S^0}{R}$	$\frac{H^0 - E_0^0}{RT} - \frac{S^0}{R}$	TEMP. (°K)	
1000	9.0389E 02	3.70707	25.6097	29.3167	7.36656	50.8906	58.2572	5.3794E 03	7.3664E 03	5.0891E 04	1000
1200	1.1339E 03	3.78118	26.2922	30.0734	7.51382	52.2470	59.7608	6.6320E 03	9.0160E 03	6.2694E 04	1200
1400	1.3866E 03	3.84745	26.8802	30.7276	7.64552	53.4153	61.0608	7.9217E 03	1.0704E 04	7.4781E 04	1400
1600	1.6488E 03	3.90571	27.3978	31.3035	7.76129	54.4440	62.2053	9.2306E 03	1.2410E 04	8.7110E 04	1600
1800	1.9752E 03	3.95677	27.8660	31.8176	7.86275	55.3641	63.2268	1.0576E 04	1.4153E 04	9.9455E 04	1800
2000	2.3083E 03	4.00163	28.2801	32.2817	7.95190	56.1972	64.1491	1.1929E 04	1.5904E 04	1.1239E 05	2000
2200	2.6385E 03	4.04127	28.6634	32.7047	8.03048	56.9586	64.9896	1.3296E 04	1.7667E 04	1.2531E 05	2200
2400	3.0562E 03	4.07654	29.0166	33.0931	8.10767	57.6607	65.7615	1.4673E 04	1.9442E 04	1.3833E 05	2400
2600	3.4717E 03	4.10813	29.3441	33.4523	8.16353	58.3116	66.4752	1.6059E 04	2.1223E 04	1.5161E 05	2600
2800	3.9153E 03	4.13664	29.6496	33.7863	8.22018	58.9187	67.1369	1.7452E 04	2.3017E 04	1.6497E 05	2800
3000	4.3872E 03	4.16255	29.9359	34.0985	8.27167	59.4877	67.7593	1.8854E 04	2.4815E 04	1.7844E 05	3000
3200	4.8879E 03	4.18624	30.2053	34.3916	8.31874	60.0230	68.3418	2.0261E 04	2.6620E 04	1.9207E 05	3200
3400	5.4176E 03	4.20807	30.4598	34.6539	8.36212	60.5287	68.8908	2.1675E 04	2.8431E 04	2.0580E 05	3400
3600	5.9768E 03	4.22831	30.7009	34.9292	8.40236	61.0078	69.4101	2.3095E 04	3.0248E 04	2.1963E 05	3600
3800	6.5654E 03	4.24724	30.9300	35.1773	8.43946	61.4631	69.9031	2.4521E 04	3.2072E 04	2.3334E 05	3800
4000	7.1843E 03	4.26505	31.1483	35.4134	8.47337	61.8969	70.3723	2.5953E 04	3.3901E 04	2.4759E 05	4000
4200	7.8336E 03	4.28198	31.3569	35.6388	8.50900	62.3112	70.8202	2.7392E 04	3.5738E 04	2.6171E 05	4200
4400	8.5139E 03	4.29820	31.5564	35.8546	8.54123	62.7078	71.2491	2.8832E 04	3.7581E 04	2.7591E 05	4400
4600	9.2256E 03	4.31388	31.7478	36.0617	8.57240	63.0882	71.6606	3.0282E 04	3.9433E 04	2.9021E 05	4600
4800	9.9692E 03	4.32920	31.9318	36.2610	8.60284	63.4537	72.0565	3.1759E 04	4.1294E 04	3.0458E 05	4800
5000	1.0745E 04	4.34430	32.1088	36.4531	8.63285	63.8055	72.4383	3.3228E 04	4.3164E 04	3.1903E 05	5000
5200	1.1555E 04	4.35933	32.2795	36.6388	8.66271	64.1446	72.8074	3.4713E 04	4.5044E 04	3.3355E 05	5200
5400	1.2398E 04	4.37442	32.4443	36.8187	8.69270	64.4721	73.1648	3.6210E 04	4.6941E 04	3.4813E 05	5400
5600	1.3277E 04	4.38968	32.6036	36.9933	8.72303	64.7888	73.5118	3.7721E 04	4.8849E 04	3.6312E 05	5600
5800	1.4191E 04	4.40522	32.7579	37.1632	8.75390	65.0955	73.8494	3.9247E 04	5.0773E 04	3.7759E 05	5800
6000	1.5142E 04	4.42111	32.9076	37.3287	8.78547	65.3928	74.1782	4.0790E 04	5.2713E 04	3.9236E 05	6000
6200	1.6130E 04	4.43741	33.0528	37.4902	8.81786	65.6814	74.4992	4.2350E 04	5.4678E 04	4.0722E 05	6200
6400	1.7158E 04	4.45417	33.1919	37.6481	8.85118	65.9618	74.8130	4.3930E 04	5.6648E 04	4.2216E 05	6400
6600	1.8224E 04	4.47142	33.3313	37.8037	8.88545	66.2347	75.1202	4.5529E 04	5.8644E 04	4.3713E 05	6600
6800	1.9336E 04	4.48916	33.4650	37.9562	8.92070	66.5005	75.4212	4.7144E 04	6.0661E 04	4.5220E 05	6800
7000	2.0490E 04	4.50737	33.5954	38.1028	8.95690	66.7596	75.7165	4.8798E 04	6.2698E 04	4.6732E 05	7000
7200	2.1687E 04	4.52605	33.7226	38.2487	8.99401	67.0125	76.0065	5.0449E 04	6.4757E 04	4.8249E 05	7200
7400	2.2931E 04	4.54513	33.8469	38.3920	9.03193	67.2594	76.2913	5.2131E 04	6.6834E 04	4.9772E 05	7400
7600	2.4223E 04	4.56458	33.9684	38.5330	9.07077	67.5008	76.5714	5.3834E 04	6.8934E 04	5.1301E 05	7600
7800	2.5564E 04	4.58451	34.0872	38.6713	9.10979	67.7369	76.8467	5.5558E 04	7.1054E 04	5.2835E 05	7800
8000	2.6956E 04	4.60427	34.2035	38.8078	9.14944	67.9680	77.1175	5.7298E 04	7.3195E 04	5.4374E 05	8000
8200	2.8401E 04	4.62436	34.3175	38.9418	9.18936	68.1945	77.3838	5.9058E 04	7.5315E 04	5.5910E 05	8200
8400	2.9900E 04	4.64449	34.4291	39.0736	9.22938	68.4164	77.6458	6.0833E 04	7.7421E 04	5.7470E 05	8400
8600	3.1454E 04	4.66459	34.5387	39.2032	9.26931	68.6340	77.9033	6.2628E 04	7.9519E 04	5.9025E 05	8600
8800	3.3067E 04	4.68456	34.6461	39.3307	9.30899	68.8476	78.1566	6.4432E 04	8.1716E 04	6.0586E 05	8800
9000	3.4739E 04	4.70431	34.7516	39.4559	9.34823	69.0572	78.4055	6.6250E 04	8.4134E 04	6.2151E 05	9000
9200	3.6471E 04	4.72375	34.8552	39.5790	9.38687	69.2631	78.6500	6.8077E 04	8.6359E 04	6.3722E 05	9200
9400	3.8265E 04	4.74280	34.9570	39.6998	9.42473	69.4654	78.8901	6.9913E 04	8.8592E 04	6.5297E 05	9400
9600	4.0123E 04	4.76139	35.0571	39.8185	9.46167	69.6642	79.1259	7.1759E 04	9.0832E 04	6.6843E 05	9600
9800	4.2046E 04	4.77944	35.1554	39.9349	9.49753	69.8597	79.3572	7.3602E 04	9.3074E 04	6.8443E 05	9800



TABLE 93 (CONT.) IDEAL GAS FUNCTIONS FOR O<sub>2</sub>

TEMP. (°K)	PARTIT. FUNC.	$\frac{h^2}{RT}$	$\frac{5}{2} \ln \frac{2\pi m}{h^2}$	$\ln \frac{h^2}{RT} - \frac{5}{2} \ln \frac{2\pi m}{h^2}$	$\frac{5}{2}$	$\frac{h^2}{RT} - \frac{5}{2} \ln \frac{2\pi m}{h^2}$	$\frac{h^2}{RT} - \frac{5}{2} \ln \frac{2\pi m}{h^2}$	$\frac{h^2}{RT} - \frac{5}{2} \ln \frac{2\pi m}{h^2}$	TEMP. (°K)
10000	4.4034E 04	4.79688	40.0490	9.53218	70.0519	79.5841	7.5450E 04	9.9322E 04	7.0052E 05
10500	4.9307E 04	4.83744	35.4872	9.61280	70.5190	80.1318	8.0049E 04	1.0093E 05	7.4049E 05
11000	5.5017E 04	4.87312	35.7131	9.68370	70.9678	90.4515	8.4662E 04	1.0452E 05	7.8065E 05
11500	6.1180E 04	4.90344	40.8338	9.74394	71.4937	81.1436	8.9203E 04	1.1204E 05	8.2110E 05
12000	6.7806E 04	4.92817	41.0678	9.79310	71.8154	81.6085	9.3671E 04	1.1752E 05	8.6179E 05
12500	7.4902E 04	4.94732	41.2885	9.83114	72.2160	82.0472	9.8050E 04	1.2209E 05	9.0270E 05
13000	8.2472E 04	4.96103	41.4766	9.85838	72.6022	82.4605	1.0233E 05	1.2614E 05	9.4383E 05
13500	9.0515E 04	4.96957	36.7229	9.87336	72.9746	82.8499	1.0449E 05	1.3332E 05	9.8516E 05
14000	9.9028E 04	4.97332	36.9038	9.88281	73.3339	83.2167	1.1054E 05	1.3834E 05	1.0267E 06
14500	1.0801E 05	4.97267	37.0783	9.88153	73.6807	83.5622	1.1447E 05	1.4328E 05	1.0684E 06
15000	1.1744E 05	4.96807	37.2468	9.87237	74.0155	83.8879	1.1828E 05	1.4809E 05	1.1102E 06
15500	1.2733E 05	4.95994	42.3149	9.85622	74.3390	84.1952	1.2197E 05	1.5277E 05	1.1523E 06
16000	1.3765E 05	4.94870	42.5156	9.83389	74.6516	84.4855	1.2555E 05	1.5734E 05	1.1944E 06
16500	1.4839E 05	4.93476	42.6537	9.80619	74.9538	84.7600	1.2901E 05	1.6180E 05	1.2367E 06
17000	1.5954E 05	4.91849	42.7845	9.77386	75.2460	85.0199	1.3237E 05	1.6616E 05	1.2792E 06
17500	1.7108E 05	4.90024	42.9086	9.73758	75.5289	85.2664	1.3563E 05	1.7041E 05	1.3218E 06
18000	1.8300E 05	4.88031	43.0264	9.69798	75.8026	85.5004	1.3879E 05	1.7454E 05	1.3644E 06
18500	1.9527E 05	4.85898	43.1385	9.65559	76.0438	85.7234	1.4187E 05	1.7843E 05	1.4071E 06
19000	2.0789E 05	4.83650	43.2453	9.61092	76.2537	85.9356	1.4485E 05	1.8218E 05	1.4502E 06
19500	2.2083E 05	4.81309	43.3472	9.56441	76.5737	86.1381	1.4776E 05	1.8651E 05	1.4931E 06
20000	2.3408E 05	4.78895	43.4446	9.51643	76.8153	86.3317	1.5059E 05	1.9033E 05	1.5363E 06
22000	2.8978E 05	4.68811	39.1074	9.31605	77.7130	87.0290	1.6124E 05	2.0495E 05	1.7097E 06
24000	3.4902E 05	4.58566	39.5110	9.11247	78.5148	87.6273	1.7101E 05	2.1870E 05	1.8844E 06
26000	4.1079E 05	4.48591	39.8740	8.91424	79.2363	88.1506	1.8010E 05	2.3177E 05	2.0601E 06
28000	4.7424E 05	4.39099	40.2030	8.72563	79.8900	88.6156	1.8868E 05	2.4432E 05	2.2349E 06
30000	5.3869E 05	4.30186	40.5029	8.54851	80.4859	89.0344	1.9684E 05	2.5646E 05	2.4146E 06
32000	6.0351E 05	4.21876	40.7778	8.38338	81.0322	89.4156	2.0468E 05	2.6827E 05	2.5930E 06
34000	6.6822E 05	4.14158	41.0312	8.23001	81.5358	89.7458	2.1224E 05	2.7982E 05	2.7722E 06
36000	7.3249E 05	4.07002	41.2659	8.08780	82.0022	90.0900	2.1962E 05	2.9114E 05	2.9521E 06
38000	7.9590E 05	4.00369	41.4842	7.95599	82.4359	90.3919	2.2682E 05	3.0233E 05	3.1324E 06
40000	8.5836E 05	3.94217	41.6879	7.83375	82.8408	90.6746	2.3386E 05	3.1335E 05	3.3134E 06

TABLE 9A. IDEAL GAS FUNCTIONS FOR CO (MOLECULAR WEIGHT 28.0106, R = 1.98717 CAL/MOLE, 7 STATES INCLUDED)

TEMP. (°K)	PARTIT. FUNCT.	$\frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT}$	$\frac{h^2-E_0}{RT}$	TEMP. (°K)
1000	3.8033E 02	3.6131	24.5443	28.1556	7.55576	48.7735	56.0293	5.2688E 03	7.2558E 03	4.8774E 04	1600
1200	4.7192E 02	3.71824	25.2159	28.9342	7.38876	50.1082	57.4970	6.4819E 03	8.8665E 03	6.0130E 04	1800
1400	5.7214E 02	3.74087	25.7939	29.5747	7.51321	51.2567	58.7699	7.7365E 03	1.0510E 04	7.1759E 04	2000
1600	6.8143E 02	3.81758	26.3025	30.1401	7.62590	52.2674	60.0933	9.0220E 03	1.2201E 04	8.3628E 04	2200
1800	8.0008E 02	3.84824	26.7575	30.6457	7.72661	53.1716	60.4982	1.0331E 04	1.3908E 04	9.5709E 04	2400
2000	9.2831E 02	3.91339	27.1695	31.1029	7.81629	53.9904	61.8067	1.1658E 04	1.5633E 04	1.0798E 05	2600
2200	1.0654E 03	3.97364	27.5464	31.5200	7.89621	54.7392	63.0534	1.3000E 04	1.7372E 04	1.2043E 05	2800
2400	1.2147E 03	4.03936	27.8937	31.9032	7.96766	55.4293	63.9370	1.4353E 04	1.9122E 04	1.3303E 05	3000
2600	1.3711E 03	4.06185	28.2159	32.2578	8.03182	56.0697	64.1015	1.5716E 04	2.0883E 04	1.4578E 05	3200
2800	1.5394E 03	4.07097	28.5165	32.5875	8.08969	56.6670	64.7567	1.7087E 04	2.2651E 04	1.5867E 05	3400
3000	1.7175E 03	4.07358	28.7983	32.8957	8.14218	57.2270	65.3492	1.8465E 04	2.4427E 04	1.7146E 05	3600
3200	1.9052E 03	4.12145	29.0635	33.1850	8.19000	57.7540	65.9440	1.9849E 04	2.6208E 04	1.8481E 05	3800
3400	2.1034E 03	4.14350	29.3141	33.4575	8.23381	58.2519	66.4957	2.1239E 04	2.7993E 04	1.9806E 05	4000
3600	2.3138E 03	4.16375	29.5515	33.7152	8.27406	58.7237	66.9977	2.2633E 04	2.9787E 04	2.1141E 05	4200
3800	2.5308E 03	4.18247	29.7771	33.9596	8.31126	59.1720	67.4833	2.4032E 04	3.1580E 04	2.2485E 05	4400
4000	2.7601E 03	4.19394	29.9921	34.1919	8.34577	59.5992	67.9450	2.5434E 04	3.3380E 04	2.3840E 05	4600
4200	3.0000E 03	4.21601	30.1974	34.4134	8.37791	60.0072	68.3851	2.6841E 04	3.5187E 04	2.5203E 05	4800
4400	3.2505E 03	4.23112	30.3939	34.6250	8.40793	60.3976	68.8056	2.8251E 04	3.6995E 04	2.6575E 05	5000
4600	3.5115E 03	4.24531	30.5823	34.8276	8.43613	60.7720	69.2081	2.9665E 04	3.8806E 04	2.7955E 05	5200
4800	3.7834E 03	4.25868	30.7632	35.0219	8.46270	61.1316	69.5943	3.1083E 04	4.0621E 04	2.9343E 05	5400
5000	4.0661E 03	4.27133	30.9373	35.2087	8.48783	61.4776	69.9654	3.2503E 04	4.2439E 04	3.0739E 05	5600
5200	4.3595E 03	4.28335	31.1051	35.3884	8.51173	61.8110	70.3227	3.3928E 04	4.4261E 04	3.2142E 05	5800
5400	4.6641E 03	4.29481	31.2670	35.5618	8.53450	62.1326	70.6671	3.5356E 04	4.6084E 04	3.3552E 05	6000
5600	4.9797E 03	4.30579	31.4234	35.7291	8.55631	62.4434	70.9997	3.6787E 04	4.7915E 04	3.4968E 05	6200
5800	5.3063E 03	4.31637	31.5746	35.8910	8.57735	62.7440	71.3214	3.8223E 04	4.9749E 04	3.6392E 05	6400
6000	5.6443E 03	4.32664	31.7211	36.0478	8.59774	63.0352	71.6329	3.9643E 04	5.1586E 04	3.7821E 05	6600
6200	5.9934E 03	4.33665	31.8632	36.1998	8.61764	63.3174	71.9350	4.1109E 04	5.3429E 04	3.9257E 05	6800
6400	6.3548E 03	4.34649	32.0010	36.3475	8.63720	63.5913	72.2285	4.2560E 04	5.5278E 04	4.0698E 05	7000
6600	6.7273E 03	4.35624	32.1349	36.4912	8.65637	63.8574	72.5140	4.4018E 04	5.7133E 04	4.2148E 05	7200
6800	7.1117E 03	4.36598	32.2651	36.6311	8.67592	64.1161	72.7920	4.5484E 04	5.8996E 04	4.3599E 05	7400
7000	7.5080E 03	4.37577	32.3928	36.7676	8.69539	64.3679	73.0633	4.6958E 04	6.0866E 04	4.5050E 05	7600
7200	7.9164E 03	4.38577	32.5152	36.9009	8.71516	64.6131	73.3283	4.8442E 04	6.2749E 04	4.6521E 05	7800
7400	8.3374E 03	4.39592	32.6355	37.0314	8.73543	64.8522	73.5876	4.9937E 04	6.4642E 04	4.7991E 05	8000
7600	8.7710E 03	4.40644	32.7529	37.1593	8.75633	65.0854	73.8417	5.1446E 04	6.6548E 04	4.9465E 05	8200
7800	9.2176E 03	4.41738	32.8675	37.2849	8.77806	65.3131	74.0912	5.2969E 04	6.8469E 04	5.0944E 05	8400
8000	9.6775E 03	4.42882	32.9795	37.4083	8.80079	65.5357	74.3364	5.4509E 04	7.0404E 04	5.2429E 05	8600
8200	1.0151E 04	4.44086	33.0890	37.5298	8.82469	65.7533	74.5779	5.6048E 04	7.2362E 04	5.3916E 05	8800
8400	1.0639E 04	4.45354	33.1961	37.6497	8.84922	65.9662	74.8161	5.7587E 04	7.4339E 04	5.5412E 05	9000
8600	1.1141E 04	4.46700	33.3011	37.7681	8.87446	66.1744	75.0514	5.9250E 04	7.6339E 04	5.6910E 05	9200
8800	1.1658E 04	4.48126	33.4039	37.8857	8.90005	66.3792	75.2842	6.0877E 04	7.8364E 04	5.8414E 05	9400
9000	1.2191E 04	4.49647	33.5048	38.0013	8.92522	66.5796	75.5148	6.2533E 04	8.0417E 04	5.9928E 05	9600
9200	1.2740E 04	4.51263	33.6038	38.1165	8.96734	66.7764	75.7437	6.4218E 04	8.2499E 04	6.1438E 05	9800
9400	1.3308E 04	4.52981	33.7011	38.2309	9.00169	66.9696	75.9711	6.5935E 04	8.4614E 04	6.2951E 05	10000
9600	1.3890E 04	4.54807	33.7966	38.3447	9.03777	67.1595	76.1972	6.7686E 04	8.6763E 04	6.4473E 05	
9800	1.4492E 04	4.56745	33.8906	38.4580	9.07627	67.3462	76.4225	6.9473E 04	8.8947E 04	6.5999E 05	

TABLE 94 (CONT.). IDEAL GAS FUNCTIONS FOR CO

[illegible]

TABLE 95. FRACTIONAL ELECTRONIC POPULATIONS OF N2

TEMP. (°K)	$X^{1\Sigma^+}_g$	$A^{2\Sigma^+}_u$	STATE $^2\Delta_u$	$B^3\Pi_g$	$B'^3\Sigma^-_u$	$a'^1\Sigma^-_u$	$a^1\Pi_g$	$w^1\Delta_u$
1200	1.03E-00	5.86E-26	5.90E-30	1.03E-30	2.36E-34	8.10E-34	3.31E-34	1.05E-37
1400	1.00E-00	1.87E-19	2.22E-22	5.35E-23	9.33E-26	5.95E-27	3.32E-27	3.14E-28
1600	1.00E-00	1.51E-15	7.87E-18	2.50E-18	1.34E-20	1.15E-21	6.33E-22	1.30E-22
1800	1.00E-00	6.10E-13	6.54E-15	3.14E-15	3.77E-17	4.01E-18	3.33E-18	7.28E-19
2000	1.00E-00	4.46E-11	1.24E-12	5.15E-13	1.09E-14	1.36E-15	1.25E-15	3.47E-16
3200	1.00E-00	1.12E-09	5.37E-11	2.36E-11	7.64E-13	1.00E-13	1.04E-13	3.54E-14
3400	1.00E-00	1.37E-08	9.93E-10	4.44E-10	2.99E-11	3.24E-12	3.39E-12	1.30E-12
4000	1.00E-00	1.07E-07	1.03E-08	5.03E-09	4.94E-11	4.94E-11	5.40E-11	2.31E-11
4400	1.00E-00	5.10E-07	6.95E-08	3.54E-08	2.59E-09	4.59E-10	5.21E-10	2.44E-10
4800	1.00E-00	2.09E-06	3.42E-07	1.80E-07	1.58E-08	2.95E-09	3.45E-09	1.75E-09
5200	1.00E-00	4.67E-06	1.32E-06	7.13E-07	7.30E-08	1.42E-08	1.71E-08	9.23E-09
5600	1.00E-00	1.81E-05	4.21E-06	2.12E-06	2.71E-07	5.48E-08	6.73E-08	3.85E-08
6000	1.00E-00	4.28E-05	1.15E-05	6.44E-06	8.45E-07	1.77E-07	2.21E-07	1.35E-07
6400	1.00E-00	9.10E-05	2.76E-05	1.58E-05	2.30E-06	4.32E-07	6.27E-07	3.93E-07
6800	1.00E-00	1.77E-04	6.00E-05	3.49E-05	5.55E-06	1.22E-06	1.57E-06	1.02E-06
7200	9.99E-01	3.19E-04	1.20E-04	7.05E-05	1.21E-05	2.72E-06	3.56E-06	2.40E-06
7600	9.99E-01	5.41E-04	2.22E-04	1.32E-04	2.44E-05	5.59E-06	7.41E-06	5.14E-06
8000	9.99E-01	8.67E-04	3.86E-04	2.33E-04	4.59E-05	1.07E-05	1.43E-05	1.02E-05
8400	9.99E-01	1.33E-03	6.37E-04	3.87E-04	8.12E-05	1.92E-05	2.60E-05	1.90E-05
8800	9.94E-01	1.95E-03	1.00E-03	6.16E-04	1.36E-04	3.27E-05	4.47E-05	3.34E-05
9200	9.94E-01	2.77E-03	1.52E-03	9.18E-04	2.19E-04	5.31E-05	7.33E-05	5.58E-05
9600	9.92E-01	3.80E-03	2.22E-03	1.38E-03	3.34E-04	8.28E-05	1.15E-04	8.94E-05
10000	9.89E-01	5.08E-03	3.13E-03	1.96E-03	5.00E-04	1.25E-04	1.75E-04	1.30E-04
11000	9.77E-01	9.45E-03	6.61E-03	4.19E-03	1.12E-03	3.02E-04	4.30E-04	3.51E-04
12000	9.60E-01	1.56E-02	1.22E-02	7.79E-03	2.37E-03	6.23E-04	9.01E-04	7.58E-04
13000	9.39E-01	2.33E-02	2.00E-02	1.29E-02	4.23E-03	1.14E-03	1.66E-03	1.43E-03
14000	9.04E-01	3.23E-02	3.02E-02	1.96E-02	6.83E-03	1.88E-03	2.37E-03	2.44E-03
15000	8.67E-01	4.17E-02	4.23E-02	2.77E-02	1.02E-02	2.85E-03	4.24E-03	3.80E-03
16000	8.26E-01	5.17E-02	5.59E-02	3.68E-02	1.42E-02	4.05E-03	6.09E-03	5.52E-03
17000	7.82E-01	6.12E-02	7.04E-02	4.65E-02	1.87E-02	5.65E-03	8.24E-03	7.59E-03
18000	7.37E-01	7.00E-02	8.52E-02	5.64E-02	2.36E-02	6.97E-03	1.04E-02	9.89E-03
19000	6.93E-01	7.79E-02	9.97E-02	6.62E-02	2.87E-02	8.61E-03	1.32E-02	1.23E-02
20000	6.51E-01	8.47E-02	1.14E-01	7.56E-02	3.39E-02	1.03E-02	1.59E-02	1.50E-02
24000	5.08E-01	1.02E-01	1.60E-01	1.07E-01	5.32E-02	1.70E-02	2.47E-02	2.57E-02
28000	4.07E-01	1.09E-01	1.91E-01	1.29E-01	6.88E-02	2.30E-02	3.44E-02	3.55E-02
32000	3.39E-01	1.10E-01	2.11E-01	1.42E-01	8.08E-02	2.78E-02	4.45E-02	4.39E-02
36000	2.92E-01	1.09E-01	2.24E-01	1.51E-01	8.99E-02	3.18E-02	5.12E-02	5.07E-02
40000	2.57E-01	1.07E-01	2.33E-01	1.57E-01	9.69E-02	3.51E-02	5.61E-02	5.65E-02

TABLE 96. FRACTIONAL ELECTRONIC POPULATIONS OF N2+

TEMP. (°K)	X <sup>2</sup> <sub>g</sub> <sup>+</sup>	A	<sup>2</sup> E <sub>g</sub>	B	<sup>2</sup> Σ <sub>g</sub> <sup>+</sup>	STATE	A <sub>u</sub>	D	<sup>2</sup> Π <sub>g</sub>	f <sub>u</sub>	C <sup>2</sup> <sub>u</sub> <sup>+</sup>
1200	1.00E-00	1.44E-04	4.43E-14	2.14E-23	9.91E-31	1.10E-26	1.10E-31	1.10E-12	1.10E-12	1.10E-12	1.10E-12
1400	9.98E-01	1.44E-03	9.32E-11	1.30E-17	4.95E-20	5.08E-20	5.08E-20	5.08E-12	5.08E-12	5.08E-12	5.08E-12
2000	9.93E-01	7.08E-03	9.13E-09	3.88E-14	3.19E-16	6.18E-16	6.18E-16	6.18E-12	6.18E-12	6.18E-12	6.18E-12
2400	9.81E-01	1.94E-02	1.92E-07	7.92E-12	2.48E-13	3.22E-13	3.22E-13	3.22E-12	3.22E-12	3.22E-12	3.22E-12
2800	9.63E-01	3.58E-02	1.84E-06	3.52E-10	2.01E-11	2.52E-11	2.52E-11	2.52E-12	2.52E-12	2.52E-12	2.52E-12
3200	9.39E-01	6.08E-02	8.43E-06	5.99E-09	5.39E-10	6.92E-10	6.92E-10	6.92E-12	6.92E-12	6.92E-12	6.92E-12
3400	9.11E-01	8.89E-02	2.93E-05	5.37E-08	6.89E-09	9.03E-09	9.03E-09	9.03E-12	9.03E-12	9.03E-12	9.03E-12
4000	8.81E-01	1.19E-01	7.85E-05	3.07E-07	5.24E-08	6.99E-08	6.99E-08	6.99E-11	6.99E-11	6.99E-11	6.99E-11
4400	8.49E-01	1.51E-01	1.75E-04	1.27E-06	2.73E-07	3.70E-07	3.70E-07	3.70E-10	3.70E-10	3.70E-10	3.70E-10
4800	8.18E-01	1.82E-01	3.38E-04	4.09E-06	1.08E-06	1.47E-06	1.47E-06	1.47E-09	1.47E-09	1.47E-09	1.47E-09
5200	7.88E-01	2.11E-01	5.47E-04	1.10E-05	3.41E-06	4.68E-06	4.68E-06	4.68E-07	4.68E-07	4.68E-07	4.68E-07
5400	7.59E-01	2.40E-01	9.40E-04	2.51E-05	9.11E-05	1.26E-05	1.26E-05	1.26E-08	1.26E-08	1.26E-08	1.26E-08
6000	7.32E-01	2.67E-01	1.41E-03	5.13E-05	2.13E-05	2.93E-05	2.93E-05	2.93E-07	2.93E-07	2.93E-07	2.93E-07
6400	7.06E-01	2.91E-01	2.00E-03	9.68E-05	4.45E-05	6.11E-05	6.11E-05	6.11E-07	6.11E-07	6.11E-07	6.11E-07
6800	6.83E-01	3.14E-01	2.72E-03	1.67E-04	8.50E-05	1.16E-04	1.16E-04	1.16E-06	1.16E-06	1.16E-06	1.16E-06
7200	6.61E-01	3.35E-01	3.58E-03	2.69E-04	1.51E-04	2.04E-04	2.04E-04	2.04E-06	2.04E-06	2.04E-06	2.04E-06
7600	6.40E-01	3.52E-01	4.56E-03	4.12E-04	2.51E-04	3.36E-04	3.36E-04	3.36E-06	3.36E-06	3.36E-06	3.36E-06
8000	6.21E-01	3.72E-01	5.67E-03	6.06E-04	3.98E-04	5.23E-04	5.23E-04	5.23E-06	5.23E-06	5.23E-06	5.23E-06
8400	6.03E-01	3.88E-01	6.89E-03	8.41E-04	5.94E-04	7.78E-04	7.78E-04	7.78E-06	7.78E-06	7.78E-06	7.78E-06
8800	5.86E-01	4.03E-01	8.22E-03	1.14E-03	8.62E-04	1.11E-03	1.11E-03	1.11E-06	1.11E-06	1.11E-06	1.11E-06
9200	5.70E-01	4.16E-01	9.64E-03	1.49E-03	1.21E-03	1.53E-03	1.53E-03	1.53E-06	1.53E-06	1.53E-06	1.53E-06
9400	5.55E-01	4.28E-01	1.12E-02	1.91E-03	1.63E-03	2.04E-03	2.04E-03	2.04E-06	2.04E-06	2.04E-06	2.04E-06
10000	5.41E-01	4.38E-01	1.28E-02	2.38E-03	2.14E-03	2.65E-03	2.65E-03	2.65E-06	2.65E-06	2.65E-06	2.65E-06
11000	5.09E-01	4.80E-01	1.70E-02	3.82E-03	3.91E-03	4.61E-03	4.61E-03	4.61E-06	4.61E-06	4.61E-06	4.61E-06
12000	4.82E-01	4.77E-01	2.14E-02	5.56E-03	6.33E-03	7.16E-03	7.16E-03	7.16E-06	7.16E-06	7.16E-06	7.16E-06
13000	4.57E-01	4.88E-01	2.58E-02	7.51E-03	9.40E-03	1.02E-02	1.02E-02	1.02E-06	1.02E-06	1.02E-06	1.02E-06
14000	4.35E-01	4.95E-01	3.01E-02	9.60E-03	1.31E-02	1.37E-02	1.37E-02	1.37E-06	1.37E-06	1.37E-06	1.37E-06
15000	4.15E-01	5.00E-01	3.42E-02	1.17E-02	1.72E-02	1.73E-02	1.73E-02	1.73E-06	1.73E-06	1.73E-06	1.73E-06
16000	3.98E-01	5.02E-01	3.80E-02	1.38E-02	2.17E-02	2.11E-02	2.11E-02	2.11E-06	2.11E-06	2.11E-06	2.11E-06
17000	3.82E-01	5.02E-01	4.19E-02	1.59E-02	2.64E-02	2.49E-02	2.49E-02	2.49E-06	2.49E-06	2.49E-06	2.49E-06
18000	3.68E-01	5.01E-01	4.44E-02	1.78E-02	3.12E-02	2.87E-02	2.87E-02	2.87E-06	2.87E-06	2.87E-06	2.87E-06
19000	3.55E-01	4.98E-01	4.74E-02	1.96E-02	3.62E-02	3.22E-02	3.22E-02	3.22E-06	3.22E-06	3.22E-06	3.22E-06
20000	3.44E-01	4.96E-01	4.99E-02	2.13E-02	4.11E-02	3.57E-02	3.57E-02	3.57E-06	3.57E-06	3.57E-06	3.57E-06
24000	3.08E-01	4.81E-01	5.76E-02	2.68E-02	5.98E-02	4.65E-02	4.65E-02	4.65E-06	4.65E-06	4.65E-06	4.65E-06
28000	2.83E-01	4.65E-01	6.24E-02	3.06E-02	7.60E-02	5.83E-02	5.83E-02	5.83E-06	5.83E-06	5.83E-06	5.83E-06
32000	2.65E-01	4.51E-01	6.54E-02	3.32E-02	8.97E-02	6.29E-02	6.29E-02	6.29E-06	6.29E-06	6.29E-06	6.29E-06
36000	2.52E-01	4.39E-01	6.74E-02	3.51E-02	1.01E-01	6.78E-02	6.78E-02	6.78E-06	6.78E-06	6.78E-06	6.78E-06
40000	2.41E-01	4.29E-01	6.88E-02	3.65E-02	1.11E-01	7.16E-02	7.16E-02	7.16E-06	7.16E-06	7.16E-06	7.16E-06

TABLE 97. FRACTIONAL ELECTRONIC POPULATIONS OF NO

TEMP. (°K)	STATE						
	X <sup>2</sup> <sub>Π</sub>	a <sup>4</sup> <sub>Π</sub>	A <sup>2</sup> <sub>Σ</sub> <sup>+</sup>	B <sup>3</sup> <sub>Π</sub>	b <sup>4</sup> <sub>Σ</sub> <sup>+</sup>	C <sup>2</sup> <sub>Π</sub>	D <sup>2</sup> <sub>Σ</sub> <sup>+</sup>
1200	1.00E 00	6.98E-20	4.22E-24	4.22E-24	4.69E-25	4.63E-28	7.80E-29
1600	1.00E 00	6.50E-15	2.28E-18	3.74E-18	6.89E-19	2.91E-21	6.47E-22
2000	1.00E 00	6.31E-12	6.28E-15	1.40E-14	3.40E-15	3.48E-17	9.07E-18
2400	1.00E 00	6.23E-10	1.22E-12	3.38E-12	9.93E-13	1.81E-14	5.21E-15
2800	1.00E 00	1.67E-08	5.22E-11	1.71E-10	5.76E-11	1.57E-12	4.81E-13
3200	1.00E 00	1.96E-07	8.67E-10	3.26E-09	1.21E-09	4.42E-11	1.41E-11
3600	1.00E 00	1.33E-06	7.64E-09	3.23E-09	1.30E-08	5.90E-10	1.93E-10
4000	1.00E 00	6.17E-06	4.32E-08	2.02E-07	8.74E-08	4.65E-09	1.54E-09
4400	1.00E 00	2.15E-05	1.76E-07	9.08E-07	4.14E-07	2.50E-08	8.35E-09
4800	1.00E 00	6.05E-05	5.65E-07	3.18E-06	1.52E-06	1.01E-07	3.37E-08
5200	1.00E 00	1.45E-04	1.50E-06	9.17E-06	4.54E-06	3.26E-07	1.09E-07
5600	1.00E 00	3.03E-04	3.44E-06	2.27E-05	1.16E-05	8.84E-07	2.94E-07
6000	9.99E-01	5.73E-04	7.00E-06	4.98E-05	2.61E-05	2.09E-06	6.89E-07
6400	9.97E-01	9.3E-04	1.29E-05	9.88E-05	5.29E-05	4.39E-06	1.44E-06
6800	9.96E-01	1.61E-03	2.21E-05	1.80E-04	9.84E-05	8.41E-06	2.75E-06
7200	9.97E-01	2.45E-03	3.54E-05	3.08E-04	1.70E-04	1.49E-05	4.84E-06
7600	9.86E-01	3.55E-03	7.38E-05	4.94E-04	2.77E-04	2.47E-05	7.98E-06
8000	9.94E-01	4.94E-03	7.75E-05	7.58E-04	4.28E-04	3.88E-05	1.24E-05
8400	9.91E-01	6.63E-03	1.08E-04	1.11E-03	6.32E-04	8.81E-05	1.85E-05
8800	9.89E-01	8.62E-03	1.44E-04	1.56E-03	8.98E-04	8.34E-05	2.64E-05
9200	9.85E-01	1.09E-02	1.87E-04	2.13E-03	1.23E-03	1.15E-04	3.63E-05
9600	9.82E-01	1.35E-02	2.58E-04	2.83E-03	1.64E-03	1.55E-04	4.85E-05
10000	9.77E-01	1.63E-02	2.94E-04	3.65E-03	2.13E-03	2.02E-04	6.29E-05
11000	9.65E-01	2.44E-02	4.62E-04	6.33E-03	3.73E-03	3.54E-04	1.09E-04
12000	9.49E-01	3.35E-02	6.59E-04	9.87E-03	5.83E-03	5.61E-04	1.70E-04
13000	9.32E-01	4.31E-02	8.77E-04	1.42E-02	8.40E-03	8.10E-04	2.44E-04
14000	9.14E-01	5.28E-02	1.11E-03	1.92E-02	1.13E-02	1.10E-03	3.28E-04
15000	8.95E-01	6.22E-02	1.34E-03	2.46E-02	1.46E-02	1.41E-03	4.16E-04
16000	8.76E-01	7.13E-02	1.56E-03	3.04E-02	1.80E-02	1.74E-03	5.09E-04
17000	8.58E-01	7.97E-02	1.78E-03	3.64E-02	2.16E-02	2.08E-03	6.05E-04
18000	8.40E-01	8.76E-02	1.99E-03	4.26E-02	2.51E-02	2.42E-03	7.00E-04
19000	8.22E-01	9.47E-02	2.18E-03	4.87E-02	2.87E-02	2.76E-03	7.93E-04
20000	8.05E-01	1.01E-01	2.34E-03	5.47E-02	3.22E-02	3.09E-03	8.84E-04
24000	7.47E-01	1.22E-01	2.94E-03	7.74E-02	4.53E-02	4.31E-03	1.21E-03
28000	7.11E-01	1.35E-01	3.38E-03	9.70E-02	5.64E-02	5.32E-03	1.48E-03
32000	6.65E-01	1.44E-01	3.69E-03	1.13E-01	6.54E-02	6.15E-03	1.69E-03
36000	6.36E-01	1.51E-01	3.91E-03	1.27E-01	7.32E-02	6.85E-03	1.87E-03
40000	6.13E-01	1.55E-01	4.08E-03	1.39E-01	7.95E-02	7.39E-03	2.01E-03

TABLE 98. FRACTIONAL ELECTRONIC POPULATIONS OF NO<sup>+</sup>

TEMP. (°K)	X <sup>1</sup> Σ <sup>+</sup>	a <sup>3</sup> Σ <sup>+</sup>	STATE 3Δ	3Π	A <sup>1</sup> Π	3Σ <sup>-</sup>
1200	1.00E-00	6.51E-21	2.00E-30	4.44E-33	7.21E-39	0.
1600	1.00E-00	1.06E-15	9.22E-23	9.30E-25	8.54E-29	1.54E-28
2000	1.00E-00	1.48E-12	3.67E-18	9.19E-20	5.55E-23	8.79E-23
2400	1.00E-00	1.83E-10	4.29E-15	1.97E-16	3.01E-19	6.05E-19
2800	1.00E-00	5.74E-09	6.68E-13	4.74E-14	1.62E-16	3.32E-16
3200	1.00E-00	7.62E-08	2.95E-11	2.90E-12	1.82E-14	3.74E-14
3600	1.00E-00	5.71E-07	5.82E-10	7.14E-11	1.18E-13	1.46E-12
4000	1.00E-00	2.86E-06	5.94E-09	9.27E-10	1.34E-11	2.72E-11
4400	1.00E-00	1.07E-05	4.10E-08	7.58E-09	1.51E-10	2.94E-10
4800	1.00E-00	3.22E-05	2.06E-07	4.37E-08	1.13E-09	2.12E-09
5200	1.00E-00	8.14E-05	8.07E-07	1.93E-07	6.16E-09	1.12E-08
5600	1.00E-00	1.82E-04	2.61E-06	6.89E-07	2.64E-08	4.62E-08
6000	1.00E-00	3.63E-04	7.22E-06	2.08E-06	9.30E-08	1.57E-07
6400	9.99E-01	6.65E-04	1.76E-05	5.47E-06	2.79E-07	4.53E-07
6800	9.99E-01	1.14E-03	3.88E-05	1.28E-05	7.35E-07	1.15E-06
7200	9.98E-01	1.83E-03	7.83E-05	2.74E-05	1.73E-06	2.61E-06
7600	9.97E-01	2.80E-03	1.47E-04	5.40E-05	3.72E-06	5.40E-06
8000	9.96E-01	4.10E-03	2.58E-04	9.93E-05	7.39E-06	1.04E-05
8400	9.94E-01	5.78E-03	4.30E-04	1.72E-04	1.37E-05	1.85E-05
8800	9.91E-01	7.90E-03	6.84E-04	2.83E-04	2.39E-05	3.14E-05
9200	9.88E-01	1.05E-02	1.04E-03	4.45E-04	3.94E-05	5.04E-05
9600	9.84E-01	1.34E-02	1.53E-03	6.71E-04	6.26E-05	7.75E-05
10000	9.79E-01	1.72E-02	2.18E-03	9.78E-04	9.52E-05	1.15E-04
11000	9.64E-01	2.87E-02	4.66E-03	2.20E-03	2.34E-04	2.64E-04
12000	9.43E-01	4.33E-02	8.85E-03	4.25E-03	4.84E-04	5.16E-04
13000	9.16E-01	6.04E-02	1.44E-02	7.27E-03	8.77E-04	8.89E-04
14000	8.85E-01	7.93E-02	2.18E-02	1.13E-02	1.43E-03	1.38E-03
15000	8.50E-01	9.89E-02	3.08E-02	1.63E-02	2.14E-03	1.99E-03
16000	8.13E-01	1.18E-01	4.10E-02	2.21E-02	2.99E-03	2.68E-03
17000	7.75E-01	1.37E-01	5.21E-02	2.85E-02	3.95E-03	3.43E-03
18000	7.36E-01	1.54E-01	6.34E-02	3.52E-02	5.00E-03	4.22E-03
19000	7.02E-01	1.70E-01	7.52E-02	4.21E-02	6.10E-03	5.01E-03
20000	6.67E-01	1.84E-01	8.68E-02	4.90E-02	7.22E-03	5.78E-03
24000	5.53E-01	2.24E-01	1.28E-01	7.44E-02	1.16E-02	8.53E-03
28000	4.73E-01	2.46E-01	1.61E-01	9.48E-02	1.52E-02	1.06E-02
32000	4.18E-01	2.57E-01	1.85E-01	1.10E-01	1.82E-02	1.21E-02
36000	3.78E-01	2.63E-01	2.03E-01	1.22E-01	2.05E-02	1.31E-02
40000	3.49E-01	2.65E-01	2.17E-01	1.32E-01	2.24E-02	1.39E-02

TABLE 99. FRACTIONAL ELECTRONIC POPULATIONS OF O<sub>2</sub>

TEMP. (°K)	X 3 $\Sigma_g^-$	A 1 $\Delta_g$	b 1 $\Sigma_g^+$	C 2 $\Delta_u$	A 3 $\Sigma_u^+$	c 1 $\Sigma_u^-$	B 3 $\Sigma_u^-$
1200	1.00E-00	5.51E-05	5.27E-06	5.70E-18	1.35E-14	1.44E-19	5.51E-26
1600	9.99E-01	5.73E-04	2.73E-06	1.84E-13	5.20E-14	8.18E-15	1.63E-19
2000	9.98E-01	2.39E-03	2.91E-05	9.23E-11	2.89E-11	5.68E-12	1.25E-15
2400	9.94E-01	6.16E-03	1.41E-04	5.73E-09	1.90E-09	4.29E-10	4.80E-13
2800	9.88E-01	1.21E-02	4.35E-04	1.08E-07	3.68E-08	9.11E-09	3.31E-11
3200	9.79E-01	1.99E-02	1.01E-03	9.54E-07	3.30E-07	8.73E-08	7.76E-10
3600	9.69E-01	2.91E-02	1.93E-03	5.04E-06	1.78E-06	4.92E-07	8.84E-08
4000	9.57E-01	3.88E-02	2.25E-03	1.88E-05	6.68E-06	1.92E-06	6.08E-08
4400	9.43E-01	5.09E-02	4.95E-03	5.44E-05	1.94E-05	5.72E-06	2.89E-07
4800	9.30E-01	6.23E-02	7.01E-03	1.28E-04	4.62E-05	1.39E-05	1.04E-06
5200	9.16E-01	7.38E-02	9.39E-03	2.62E-04	9.50E-05	2.92E-05	3.05E-06
5600	9.02E-01	8.51E-02	1.20E-02	4.78E-04	1.74E-04	5.43E-05	7.54E-06
6000	8.88E-01	9.60E-02	1.48E-02	7.94E-04	2.90E-04	9.17E-05	1.64E-05
6400	8.74E-01	1.07E-01	1.78E-02	1.23E-03	4.49E-04	1.44E-04	3.19E-05
6800	8.60E-01	1.16E-01	2.09E-02	1.79E-03	6.54E-04	2.11E-04	5.69E-05
7200	8.46E-01	1.26E-01	2.39E-02	2.47E-03	9.07E-04	2.95E-04	9.44E-05
7600	8.33E-01	1.35E-01	2.70E-02	3.28E-03	1.21E-03	3.95E-04	1.48E-04
8000	8.21E-01	1.43E-01	3.00E-02	4.20E-03	1.55E-03	5.10E-04	2.19E-04
8400	8.09E-01	1.50E-01	3.30E-02	5.23E-03	1.93E-03	6.39E-04	3.11E-04
8800	7.97E-01	1.57E-01	3.58E-02	6.35E-03	2.34E-03	7.81E-04	4.27E-04
9200	7.84E-01	1.64E-01	3.85E-02	7.54E-03	2.79E-03	9.33E-04	5.44E-04
9600	7.75E-01	1.70E-01	4.11E-02	8.80E-03	3.25E-03	1.09E-03	7.31E-04
10000	7.65E-01	1.75E-01	4.36E-02	1.01E-02	3.74E-03	1.26E-03	9.21E-04
11000	7.42E-01	1.87E-01	4.93E-02	1.34E-02	4.99E-03	1.70E-03	1.51E-03
12000	7.22E-01	1.96E-01	5.41E-02	1.69E-02	6.27E-03	2.15E-03	2.24E-03
13000	7.05E-01	2.04E-01	5.83E-02	2.03E-02	7.53E-03	2.59E-03	3.10E-03
14000	6.89E-01	2.10E-01	6.19E-02	2.35E-02	8.73E-03	3.02E-03	4.07E-03
15000	6.76E-01	2.14E-01	6.49E-02	2.65E-02	9.87E-03	3.43E-03	5.11E-03
16000	6.64E-01	2.18E-01	6.75E-02	2.94E-02	1.09E-02	3.81E-03	6.21E-03
17000	6.53E-01	2.22E-01	6.97E-02	3.20E-02	1.19E-02	4.17E-03	7.35E-03
18000	6.44E-01	2.24E-01	7.16E-02	3.45E-02	1.28E-02	4.50E-03	8.52E-03
19000	6.35E-01	2.26E-01	7.33E-02	3.67E-02	1.37E-02	4.81E-03	9.69E-03
20000	6.28E-01	2.28E-01	7.48E-02	3.88E-02	1.45E-02	5.09E-03	1.09E-02
2400	6.04E-01	2.33E-01	7.90E-02	4.57E-02	1.70E-02	6.04E-03	1.54E-02
28000	5.87E-01	2.35E-01	8.16E-02	5.08E-02	1.89E-02	6.75E-03	1.94E-02
32000	5.74E-01	2.37E-01	8.34E-02	5.44E-02	2.04E-02	7.29E-03	2.33E-02
36000	5.65E-01	2.37E-01	8.46E-02	5.78E-02	2.15E-02	7.72E-03	2.64E-02
40000	5.57E-01	2.38E-01	8.55E-02	6.00E-02	2.24E-02	8.04E-03	2.95E-02



TABLE 100. FRACTIONAL ELECTRONIC POPULATIONS OF  $\text{G}^+$ 

TEMP. (°K)	$X \text{ } ^2\Pi_g$	$a \text{ } ^4\Pi_u$	$\lambda \text{ } ^2\Pi_u$	STATE $S \text{ } ^4\Sigma_g^-$
1200	1.00E-00	5.40E-17	2.04E-20	4.55E-26
1600	1.00E-00	9.53E-13	2.95E-15	1.17E-19
2000	1.00E-00	5.40E-10	3.06E-12	6.30E-16
2400	1.00E-00	1.72E-08	3.17E-10	3.08E-13
2800	1.00E-00	2.86E-07	6.76E-09	2.12E-11
3200	1.00E-00	2.34E-06	1.06E-07	5.10E-10
3600	1.00E-00	1.22E-05	7.36E-07	6.07E-09
4000	1.00E-00	4.55E-05	3.47E-06	4.41E-08
4400	1.00E-00	1.34E-04	1.23E-05	2.24E-07
4800	1.00E-00	3.29E-04	3.50E-05	8.64E-07
5200	9.99E-01	7.02E-04	6.44E-05	4.71E-06
5600	9.99E-01	1.34E-03	1.79E-04	7.20E-06
6000	9.97E-01	2.35E-03	3.41E-04	1.67E-05
6400	9.96E-01	3.81E-03	5.96E-04	3.45E-05
6800	9.93E-01	5.65E-03	9.70E-04	6.64E-05
7200	9.90E-01	8.46E-03	1.49E-03	1.17E-04
7600	9.86E-01	1.18E-02	2.16E-03	1.94E-04
8000	9.81E-01	1.57E-02	3.01E-03	3.04E-04
8400	9.74E-01	2.04E-02	4.05E-03	4.54E-04
8800	9.68E-01	2.57E-02	5.26E-03	6.52E-04
9200	9.61E-01	3.16E-02	6.65E-03	9.02E-04
9600	9.52E-01	3.81E-02	8.21E-03	1.21E-03
10000	9.44E-01	4.50E-02	9.91E-03	1.58E-03
11000	9.19E-01	6.37E-02	1.47E-02	2.77E-03
12000	8.92E-01	8.35E-02	2.00E-02	4.35E-03
13000	8.65E-01	1.03E-01	2.55E-02	6.26E-03
14000	8.34E-01	1.22E-01	3.09E-02	8.45E-03
15000	8.13E-01	1.40E-01	3.62E-02	1.08E-02
16000	7.89E-01	1.57E-01	4.11E-02	1.34E-02
17000	7.61E-01	1.72E-01	4.58E-02	1.60E-02
18000	7.44E-01	1.85E-01	5.00E-02	1.86E-02
19000	7.27E-01	1.98E-01	5.39E-02	2.13E-02
20000	7.10E-01	2.08E-01	5.74E-02	2.39E-02
24000	6.55E-01	2.42E-01	6.87E-02	3.38E-02
28000	6.17E-01	2.64E-01	7.66E-02	4.25E-02
32000	5.88E-01	2.80E-01	8.22E-02	4.99E-02
36000	5.67E-01	2.91E-01	8.64E-02	5.63E-02
40000	5.50E-01	2.99E-01	8.95E-02	6.17E-02

TABLE 101. FRACTIONAL ELECTRONIC POPULATIONS OF CO

TEMP. (°K)	STATE					
	$X^1\Sigma^+$	$a^3\Pi$	$a^3\Sigma^+$	$d^3\Delta$	$e^3\Sigma^-$	$I^1\Sigma^-$
1200	1.00E-00	4.18E-25	7.69E-29	2.92E-31	3.87E-33	5.10E-34
1600	1.00E-00	8.78E-19	1.36E-21	2.48E-23	8.28E-25	1.30E-26
2000	1.00E-00	5.49E-15	1.03E-17	1.44E-18	6.34E-20	1.73E-20
2400	1.00E-00	1.87E-12	2.41E-14	2.16E-15	1.82E-16	4.19E-17
2800	1.00E-00	1.20E-10	2.86E-12	4.04E-13	4.44E-14	1.10E-14
3200	1.00E-00	2.74E-09	1.03E-10	2.05E-10	2.75E-12	7.18E-13
3600	1.00E-00	3.12E-08	1.67E-09	4.16E-10	8.64E-11	1.14E-11
4000	1.00E-00	2.19E-07	1.56E-08	5.04E-09	8.95E-10	2.51E-10
4400	1.00E-00	1.08E-06	9.74E-08	1.64E-08	7.37E-09	1.61E-10
4800	1.00E-00	4.08E-06	4.48E-07	1.93E-07	4.21E-08	1.40E-09
5200	1.00E-00	1.25E-05	1.63E-06	9.20E-07	1.83E-07	5.62E-08
5600	1.00E-00	3.24E-05	4.95E-06	2.76E-06	6.78E-07	2.04E-07
6000	1.00E-00	7.58E-05	1.29E-05	7.31E-06	2.03E-06	6.21E-07
6400	1.00E-00	1.58E-04	3.90E-05	1.99E-05	5.37E-06	1.64E-06
6800	1.00E-00	3.01E-04	6.31E-05	4.47E-05	1.26E-05	3.87E-06
7200	9.93E-01	5.36E-04	1.22E-04	9.19E-05	2.68E-05	8.28E-06
7600	9.99E-01	8.96E-04	2.20E-04	1.75E-04	5.25E-05	1.63E-05
8000	9.93E-01	1.42E-03	3.74E-04	3.12E-04	9.60E-05	2.99E-05
8400	9.96E-01	2.16E-03	6.04E-04	5.24E-04	1.65E-04	5.17E-05
8800	9.95E-01	3.16E-03	9.32E-04	8.40E-04	2.70E-04	8.47E-05
9200	9.92E-01	4.46E-03	1.38E-03	1.79E-03	4.23E-04	1.33E-04
9600	9.83E-01	6.11E-03	1.96E-03	1.90E-03	6.34E-04	1.99E-04
10000	9.65E-01	8.15E-03	2.75E-03	2.71E-03	9.11E-04	2.89E-04
11000	9.79E-01	1.51E-02	5.56E-03	5.82E-03	2.03E-03	6.40E-04
12000	9.48E-01	2.50E-02	9.82E-03	1.08E-02	3.84E-03	1.22E-03
13000	9.13E-01	3.75E-02	1.56E-02	1.77E-02	6.43E-03	2.04E-03
14000	8.81E-01	5.21E-02	2.27E-02	2.66E-02	9.92E-03	3.11E-03
15000	8.43E-01	6.80E-02	3.07E-02	3.70E-02	1.38E-02	4.39E-03
16000	7.99E-01	8.49E-02	3.94E-02	4.84E-02	1.83E-02	5.81E-03
17000	7.55E-01	1.01E-01	4.82E-02	6.03E-02	2.31E-02	7.32E-03
18000	7.11E-01	1.16E-01	5.69E-02	7.23E-02	2.79E-02	8.84E-03
19000	6.69E-01	1.30E-01	6.52E-02	8.40E-02	3.26E-02	1.03E-02
20000	5.30E-01	1.43E-01	7.30E-02	9.51E-02	3.71E-02	1.18E-02
24000	5.05E-01	1.61E-01	9.78E-02	1.12E-01	5.27E-02	1.66E-02
28000	4.73E-01	2.06E-01	1.14E-01	1.58E-01	6.34E-02	2.01E-02
32000	3.63E-01	2.21E-01	1.25E-01	1.75E-01	7.10E-02	2.25E-02
36000	3.31E-01	2.30E-01	1.32E-01	1.86E-01	7.65E-02	2.42E-02
40000	3.05E-01	2.39E-01	1.37E-01	1.97E-01	8.06E-02	2.55E-02

TABLE 102. DIMENSIONLESS PRESSURE, PV/RT, OF EQUILIBRIUM AIR

TEMP. (DEG K)	-9.0	-8.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.5	-5.0	-4.5	-4.0
1000	3.982E 00	3.981E 00	3.979E 00	3.973E 00	3.956E 00	3.905E 00	3.773E 00	3.508E 00	3.135E 00	2.766E 00	2.477E 00
1050	3.982E 00	3.982E 00	3.981E 00	3.978E 00	3.970E 00	3.947E 00	3.808E 00	3.717E 00	3.417E 00	3.035E 00	2.682E 00
1100	3.985E 00	3.983E 00	3.982E 00	3.980E 00	3.974E 00	3.945E 00	3.932E 00	3.840E 00	3.634E 00	3.296E 00	2.913E 00
1150	3.994E 00	3.986E 00	3.983E 00	3.981E 00	3.979E 00	3.973E 00	3.956E 00	3.906E 00	3.777E 00	3.517E 00	3.149E 00
1200	4.025E 00	3.994E 00	3.986E 00	3.983E 00	3.981E 00	3.977E 00	3.947E 00	3.939E 00	3.862E 00	3.681E 00	3.365E 00
1250	4.109E 00	4.027E 00	3.997E 00	3.986E 00	3.982E 00	3.979E 00	3.973E 00	3.957E 00	3.911E 00	3.791E 00	3.544E 00
1300	4.287E 00	4.104E 00	4.025E 00	3.996E 00	3.986E 00	3.981E 00	3.977E 00	3.966E 00	3.938E 00	3.860E 00	3.688E 00
1350	4.572E 00	4.262E 00	4.092E 00	4.020E 00	3.994E 00	3.984E 00	3.979E 00	3.972E 00	3.933E 00	3.903E 00	3.775E 00
1400	4.904E 00	4.511E 00	4.224E 00	4.075E 00	4.013E 00	3.991E 00	3.982E 00	3.976E 00	3.963E 00	3.929E 00	3.840E 00
1450	5.205E 00	4.815E 00	4.435E 00	4.180E 00	4.055E 00	4.006E 00	3.988E 00	3.979E 00	3.949E 00	3.945E 00	3.883E 00
1500	5.438E 00	5.109E 00	4.705E 00	4.351E 00	4.135E 00	4.036E 00	3.998E 00	3.983E 00	3.973E 00	3.956E 00	3.911E 00
1550	5.618E 00	5.352E 00	4.987E 00	4.581E 00	4.266E 00	4.093E 00	4.019E 00	3.991E 00	3.978E 00	3.963E 00	3.930E 00
1600	5.755E 00	5.543E 00	5.237E 00	4.840E 00	4.452E 00	4.188E 00	4.058E 00	4.005E 00	3.984E 00	3.968E 00	3.942E 00
1650	5.851E 00	5.692E 00	5.442E 00	5.091E 00	4.678E 00	4.329E 00	4.123E 00	4.030E 00	3.993E 00	3.974E 00	3.952E 00
1700	5.908E 00	5.802E 00	5.606E 00	5.309E 00	4.916E 00	4.513E 00	4.223E 00	4.072E 00	4.008E 00	3.981E 00	3.959E 00
1750	5.940E 00	5.875E 00	5.733E 00	5.490E 00	5.141E 00	4.723E 00	4.360E 00	4.137E 00	4.034E 00	3.991E 00	3.966E 00
1800	5.958E 00	5.915E 00	5.824E 00	5.635E 00	5.337E 00	4.940E 00	4.531E 00	4.232E 00	4.074E 00	4.007E 00	3.974E 00
1850	5.969E 00	5.944E 00	5.894E 00	5.747E 00	5.502E 00	5.145E 00	4.722E 00	4.357E 00	4.135E 00	4.030E 00	3.984E 00
1900	5.980E 00	5.960E 00	5.921E 00	5.828E 00	5.636E 00	5.327E 00	4.919E 00	4.510E 00	4.218E 00	4.066E 00	3.999E 00
1950	5.994E 00	5.972E 00	5.944E 00	5.882E 00	5.740E 00	5.482E 00	5.108E 00	4.680E 00	4.326E 00	4.117E 00	4.019E 00
2000	6.016E 00	5.984E 00	5.960E 00	5.918E 00	5.817E 00	5.611E 00	5.280E 00	4.858E 00	4.457E 00	4.185E 00	4.048E 00
2200	6.371E 00	6.136E 00	6.031E 00	5.986E 00	5.951E 00	5.888E 00	5.745E 00	5.473E 00	5.076E 00	4.639E 00	4.293E 00
2400	7.181E 00	6.745E 00	6.356E 00	6.127E 00	6.023E 00	5.972E 00	5.917E 00	5.803E 00	5.568E 00	5.191E 00	4.744E 00
2600	7.719E 00	7.446E 00	7.050E 00	6.604E 00	6.261E 00	6.078E 00	5.994E 00	5.930E 00	5.822E 00	5.598E 00	5.225E 00
2800	7.919E 00	7.815E 00	7.607E 00	7.252E 00	6.802E 00	6.392E 00	6.138E 00	6.014E 00	5.934E 00	5.815E 00	5.579E 00
3000	7.997E 00	7.945E 00	7.863E 00	7.686E 00	7.365E 00	6.929E 00	6.486E 00	6.185E 00	6.028E 00	5.926E 00	5.784E 00
3200	8.190E 00	8.041E 00	7.966E 00	7.886E 00	7.728E 00	7.424E 00	6.988E 00	6.531E 00	6.205E 00	6.026E 00	5.901E 00
3400	8.705E 00	8.313E 00	8.093E 00	7.986E 00	7.896E 00	7.735E 00	7.431E 00	6.989E 00	6.526E 00	6.195E 00	6.005E 00
3600	9.316E 00	8.856E 00	8.418E 00	8.141E 00	8.002E 00	7.895E 00	7.718E 00	7.395E 00	6.937E 00	6.477E 00	6.154E 00
3800	9.712E 00	9.394E 00	8.944E 00	8.485E 00	8.174E 00	8.008E 00	7.880E 00	7.676E 00	7.318E 00	6.840E 00	6.393E 00
4000	9.927E 00	9.737E 00	9.424E 00	8.977E 00	8.509E 00	8.182E 00	7.899E 00	7.847E 00	7.401E 00	7.197E 00	6.704E 00
4200	1.013E 01	9.941E 00	9.739E 00	9.416E 00	8.960E 00	8.472E 00	8.166E 00	7.975E 00	7.788E 00	7.446E 00	7.031E 00
4400	1.048E 01	1.015E 01	9.940E 00	9.717E 00	9.372E 00	8.901E 00	8.439E 00	8.126E 00	7.925E 00	7.695E 00	7.323E 00
4600	1.094E 01	1.049E 01	1.015E 01	9.921E 00	9.671E 00	9.292E 00	8.802E 00	8.358E 00	8.065E 00	7.847E 00	7.553E 00
4800	1.133E 01	1.091E 01	1.046E 01	1.012E 01	9.880E 00	9.594E 00	9.172E 00	8.671E 00	8.257E 00	7.983E 00	7.728E 00
5000	1.166E 01	1.128E 01	1.085E 01	1.040E 01	1.007E 01	9.814E 00	9.481E 00	9.014E 00	8.517E 00	8.143E 00	7.871E 00
6000	1.204E 01	1.197E 01	1.189E 01	1.176E 01	1.149E 01	1.108E 01	1.058E 01	1.015E 01	9.802E 00	9.389E 00	8.863E 00
7000	1.236E 01	1.231E 01	1.220E 01	1.208E 01	1.197E 01	1.187E 01	1.167E 01	1.132E 01	1.082E 01	1.030E 01	9.856E 00
8000	1.239E 01	1.239E 01	1.238E 01	1.234E 01	1.227E 01	1.214E 01	1.201E 01	1.188E 01	1.166E 01	1.127E 01	1.079E 01

100C00	1.239E 01	1.239E 01	1.239E 01	1.239E 01	1.238E 01	1.238E 01	1.237E 01	1.237E 01	1.237E 01
150C00	1.239E 01	1.239E 01	1.239E 01	1.239E 01	1.239E 01	1.239E 01	1.239E 01	1.239E 01	1.239E 01
200C00	1.247E 01	1.243E 01	1.240E 01	1.240E 01	1.239E 01	1.239E 01	1.239E 01	1.239E 01	1.239E 01
300C00	1.502E 01	1.522E 01	1.471E 01	1.430E 01	1.386E 01	1.357E 01	1.315E 01	1.256E 01	1.244E 01
400C00	1.640E 01	1.630E 01	1.626E 01	1.613E 01	1.590E 01	1.568E 01	1.528E 01	1.473E 01	1.394E 01
500C00	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.639E 01	1.633E 01	1.621E 01	1.606E 01	1.589E 01
600C00	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.642E 01	1.640E 01	1.621E 01
800C00	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.642E 01
1000C00	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01	1.643E 01
1500C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.644E 01	1.644E 01	1.644E 01	1.643E 01	1.643E 01
2000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01
3000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01
4000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01
5000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01
6000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01
8000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01
10000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01

TABLE 102(CONT) DIMENSIONLESS PRESSURE, PV/RT, OF EQUILIBRIUM AIR

TEMP. (DEG K)	-3.5	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0
1000	2.282E 00	2.160E 00	2.087E 00	2.042E 00	2.008E 00	1.966E 00	1.886E 00	1.757E 00	1.597E 00	1.431E 00
1050	2.419E 00	2.245E 00	2.138E 00	2.073E 00	2.031E 00	1.992E 00	1.934E 00	1.827E 00	1.675E 00	1.517E 00
1100	2.587E 00	2.354E 00	2.205E 00	2.113E 00	2.057E 00	2.015E 00	1.967E 00	1.832E 00	1.746E 00	1.584E 00
1150	2.779E 00	2.487E 00	2.289E 00	2.165E 00	2.088E 00	2.038E 00	1.993E 00	1.924E 00	1.807E 00	1.650E 00
1200	2.983E 00	2.642E 00	2.392E 00	2.228E 00	2.127E 00	2.064E 00	2.015E 00	1.957E 00	1.850E 00	1.711E 00
1250	3.184E 00	2.811E 00	2.512E 00	2.305E 00	2.174E 00	2.093E 00	2.038E 00	1.983E 00	1.900E 00	1.767E 00
1300	3.366E 00	2.966E 00	2.646E 00	2.395E 00	2.231E 00	2.128E 00	2.062E 00	2.007E 00	1.933E 00	1.815E 00
1350	3.520E 00	3.157E 00	2.789E 00	2.497E 00	2.296E 00	2.169E 00	2.088E 00	2.025E 00	1.962E 00	1.857E 00
1400	3.642E 00	3.315E 00	2.937E 00	2.609E 00	2.371E 00	2.215E 00	2.110E 00	2.050E 00	1.986E 00	1.893E 00
1450	3.733E 00	3.453E 00	3.083E 00	2.727E 00	2.454E 00	2.269E 00	2.151E 00	2.073E 00	2.008E 00	1.923E 00
1500	3.799E 00	3.548E 00	3.221E 00	2.850E 00	2.543E 00	2.328E 00	2.188E 00	2.098E 00	2.029E 00	1.950E 00
1550	3.846E 00	3.600E 00	3.346E 00	2.972E 00	2.639E 00	2.393E 00	2.230E 00	2.125E 00	2.050E 00	1.973E 00
1600	3.879E 00	3.731E 00	3.456E 00	3.092E 00	2.738E 00	2.463E 00	2.275E 00	2.154E 00	2.071E 00	1.995E 00
1650	3.903E 00	3.785E 00	3.550E 00	3.204E 00	2.838E 00	2.537E 00	2.325E 00	2.186E 00	2.093E 00	2.015E 00
1700	3.919E 00	3.826E 00	3.627E 00	3.307E 00	2.938E 00	2.615E 00	2.378E 00	2.220E 00	2.116E 00	2.035E 00
1750	3.932E 00	3.856E 00	3.650E 00	3.400E 00	3.035E 00	2.694E 00	2.434E 00	2.257E 00	2.140E 00	2.054E 00
1800	3.942E 00	3.880E 00	3.746E 00	3.481E 00	3.128E 00	2.774E 00	2.492E 00	2.296E 00	2.166E 00	2.073E 00
1850	3.951E 00	3.898E 00	3.780E 00	3.551E 00	3.215E 00	2.854E 00	2.553E 00	2.337E 00	2.193E 00	2.092E 00
1900	3.960E 00	3.912E 00	3.812E 00	3.611E 00	3.295E 00	2.933E 00	2.615E 00	2.380E 00	2.221E 00	2.111E 00
1950	3.971E 00	3.924E 00	3.838E 00	3.662E 00	3.368E 00	3.009E 00	2.678E 00	2.425E 00	2.251E 00	2.131E 00
2000	3.983E 00	3.935E 00	3.859E 00	3.704E 00	3.433E 00	3.082E 00	2.740E 00	2.471E 00	2.282E 00	2.151E 00
2050	4.092E 00	3.990E 00	3.918E 00	3.815E 00	3.627E 00	3.331E 00	2.981E 00	2.660E 00	2.414E 00	2.238E 00
2100	4.360E 00	4.118E 00	3.985E 00	3.883E 00	3.742E 00	3.509E 00	3.186E 00	2.845E 00	2.552E 00	2.329E 00
2150	4.772E 00	4.374E 00	4.113E 00	3.957E 00	3.821E 00	3.630E 00	3.348E 00	3.011E 00	2.686E 00	2.422E 00
2200	5.193E 00	4.734E 00	4.338E 00	4.075E 00	3.898E 00	3.720E 00	3.475E 00	3.154E 00	2.810E 00	2.513E 00
2250	5.517E 00	5.104E 00	4.641E 00	4.261E 00	4.003E 00	3.802E 00	3.572E 00	3.274E 00	2.923E 00	2.600E 00
2300	5.724E 00	5.409E 00	4.963E 00	4.507E 00	4.151E 00	3.895E 00	3.659E 00	3.376E 00	3.023E 00	2.682E 00
2350	5.853E 00	5.624E 00	5.250E 00	4.779E 00	4.344E 00	4.014E 00	3.748E 00	3.467E 00	3.113E 00	2.758E 00
2400	5.959E 00	5.770E 00	5.474E 00	5.040E 00	4.584E 00	4.161E 00	3.847E 00	3.555E 00	3.196E 00	2.829E 00
2450	6.092E 00	5.883E 00	5.639E 00	5.265E 00	4.790E 00	4.333E 00	3.962E 00	3.643E 00	3.275E 00	2.897E 00
2500	6.284E 00	6.002E 00	5.766E 00	5.446E 00	5.002E 00	4.517E 00	4.093E 00	3.736E 00	3.353E 00	2.962E 00
2550	6.539E 00	6.155E 00	5.881E 00	5.591E 00	5.188E 00	4.701E 00	4.236E 00	3.837E 00	3.433E 00	3.025E 00
2600	6.827E 00	6.356E 00	6.008E 00	5.713E 00	5.345E 00	4.875E 00	4.385E 00	3.947E 00	3.516E 00	3.070E 00
2650	7.108E 00	6.595E 00	6.163E 00	5.830E 00	5.480E 00	5.033E 00	4.534E 00	4.063E 00	3.603E 00	3.157E 00
2700	7.353E 00	6.849E 00	6.351E 00	5.957E 00	5.601E 00	5.175E 00	4.678E 00	4.181E 00	3.695E 00	3.215E 00
2750	7.553E 00	7.092E 00	6.562E 00	6.101E 00	5.716E 00	5.302E 00	4.813E 00	4.301E 00	3.789E 00	3.276E 00
2800	7.845E 00	7.328E 00	6.759E 00	6.202E 00	5.782E 00	5.382E 00	4.877E 00	4.347E 00	3.826E 00	3.293E 00
2850	8.101E 00	7.528E 00	6.917E 00	6.317E 00	5.881E 00	5.451E 00	4.923E 00	4.373E 00	3.842E 00	3.307E 00
2900	8.323E 00	7.650E 00	7.037E 00	6.418E 00	5.967E 00	5.511E 00	4.971E 00	4.407E 00	3.867E 00	3.323E 00
2950	8.517E 00	7.849E 00	7.236E 00	6.581E 00	6.101E 00	5.611E 00	5.061E 00	4.481E 00	3.907E 00	3.342E 00

15CC00	1.231E 01	1.222E 01	1.203E 01	1.192E 00	1.041E 00	0.274E 00	7.497E 00	6.721E 00	5.942E 00	5.119E 00
2CC000	1.236E 01	1.233E 01	1.227E 01	1.171E 01	1.121E 01	1.050E 01	9.623E 00	8.664E 00	7.674E 00	6.638E 00
300C00	1.240E 01	1.237E 01	1.234E 01	1.215E 01	1.193E 01	1.152E 01	1.090E 01	1.004E 01	9.019E 00	7.884E 00
400C00	1.359E 01	1.314E 01	1.273E 01	1.248E 01	1.233E 01	1.219E 01	1.200E 01	1.169E 01	1.120E 01	1.045E 01
5CC000	1.512E 01	1.454E 01	1.405E 01	1.362E 01	1.312E 01	1.244E 01	1.228E 01	1.194E 01	1.155E 01	1.094E 01
600C00	1.603E 01	1.579E 01	1.538E 01	1.479E 01	1.419E 01	1.343E 01	1.305E 01	1.246E 01	1.192E 01	1.134E 01
800C00	1.641E 01	1.638E 01	1.630E 01	1.614E 01	1.584E 01	1.542E 01	1.478E 01	1.401E 01	1.322E 01	1.239E 01
1000C00	1.642E 01	1.642E 01	1.640E 01	1.637E 01	1.629E 01	1.612E 01	1.580E 01	1.528E 01	1.452E 01	1.360E 01
1500C00	1.643E 01	1.642E 01	1.642E 01	1.641E 01	1.639E 01	1.635E 01	1.629E 01	1.615E 01	1.589E 01	1.541E 01
2000C00	1.643E 01	1.643E 01	1.642E 01	1.642E 01	1.641E 01	1.638E 01	1.635E 01	1.627E 01	1.614E 01	1.590E 01
3000C00	1.645E 01	1.644E 01	1.644E 01	1.643E 01	1.642E 01	1.641E 01	1.639E 01	1.635E 01	1.628E 01	1.616E 01
4000C00	1.645E 01	1.645E 01	1.645E 01	1.644E 01	1.644E 01	1.643E 01	1.641E 01	1.638E 01	1.634E 01	1.626E 01
5000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.644E 01	1.644E 01	1.643E 01	1.641E 01	1.638E 01	1.632E 01
6000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.644E 01	1.643E 01	1.642E 01	1.640E 01	1.635E 01
8000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.644E 01	1.644E 01	1.643E 01	1.642E 01	1.639E 01
10000C00	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.645E 01	1.644E 01	1.644E 01	1.643E 01	1.641E 01



[illegible]



TABLE 103(CONT) PRESSURE (ATM) OF EQUILIBRIUM AIR

TEMP. (DEG K)	-3.5	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0
10500	2.642E-02	7.909E-02	2.416E-01	7.475E-01	2.324E 00	7.196E 00	2.186E 01	6.433E 01	1.848E 02	5.314E 02
10500	2.940E-02	8.630E-02	2.599E-01	7.948E-01	2.448E 00	7.458E 00	2.350E 01	7.024E 01	2.035E 02	5.832E 02
11000	3.294E-02	9.480E-02	2.808E-01	8.510E-01	2.619E 00	8.115E 00	2.504E 01	7.580E 01	2.225E 02	6.300E 02
11500	3.700E-02	1.047E-01	3.048E-01	9.113E-01	2.780E 00	8.581E 00	2.653E 01	8.102E 01	2.406E 02	6.944E 02
12000	4.144E-02	1.161E-01	3.323E-01	9.790E-01	2.955E 00	9.066E 00	2.800E 01	8.597E 01	2.581E 02	7.517E 02
12500	4.607E-02	1.284E-01	3.635E-01	1.055E 00	3.147E 00	9.579E 00	2.949E 01	9.077E 01	2.749E 02	8.044E 02
13000	5.066E-02	1.421E-01	3.982E-01	1.140E 00	3.357E 00	1.013E 01	3.103E 01	9.550E 01	2.910E 02	8.639E 02
13500	5.502E-02	1.560E-01	4.359E-01	1.234E 00	3.589E 00	1.072E 01	3.263E 01	1.003E 02	3.066E 02	9.178E 02
14000	5.902E-02	1.699E-01	4.761E-01	1.337E 00	3.842E 00	1.135E 01	3.432E 01	1.051E 02	3.219E 02	9.701E 02
14500	6.266E-02	1.833E-01	5.175E-01	1.448E 00	4.119E 00	1.204E 01	3.611E 01	1.101E 02	3.371E 02	1.021E 03
15000	6.597E-02	1.959E-01	5.593E-01	1.565E 00	4.417E 00	1.278E 01	3.800E 01	1.152E 02	3.524E 02	1.071E 03
15500	6.901E-02	2.077E-01	6.005E-01	1.687E 00	4.735E 00	1.358E 01	4.001E 01	1.206E 02	3.679E 02	1.120E 03
16000	7.185E-02	2.185E-01	6.402E-01	1.811E 00	5.071E 00	1.445E 01	4.215E 01	1.262E 02	3.836E 02	1.169E 03
16500	7.455E-02	2.286E-01	6.781E-01	1.935E 00	5.421E 00	1.533E 01	4.441E 01	1.320E 02	3.998E 02	1.217E 03
17000	7.714E-02	2.381E-01	7.139E-01	2.058E 00	5.792E 00	1.627E 01	4.680E 01	1.382E 02	4.165E 02	1.264E 03
17500	7.964E-02	2.471E-01	7.476E-01	2.178E 00	6.149E 00	1.726E 01	4.931E 01	1.446E 02	4.334E 02	1.316E 03
18000	8.215E-02	2.557E-01	7.794E-01	2.294E 00	6.518E 00	1.828E 01	5.194E 01	1.513E 02	4.514E 02	1.364E 03
18500	8.463E-02	2.640E-01	8.096E-01	2.405E 00	6.885E 00	1.933E 01	5.468E 01	1.583E 02	4.697E 02	1.417E 03
19000	8.711E-02	2.721E-01	8.385E-01	2.512E 00	7.248E 00	2.040E 01	5.752E 01	1.654E 02	4.884E 02	1.469E 03
19500	8.963E-02	2.801E-01	8.664E-01	2.614E 00	7.603E 00	2.148E 01	6.045E 01	1.731E 02	5.081E 02	1.521E 03
20000	9.223E-02	2.881E-01	8.934E-01	2.712E 00	7.950E 00	2.257E 01	6.345E 01	1.809E 02	5.283E 02	1.575E 03
20500	9.482E-02	2.961E-01	9.197E-01	2.809E 00	8.298E 00	2.368E 01	6.653E 01	1.891E 02	5.496E 02	1.630E 03
21000	9.741E-02	3.041E-01	9.459E-01	2.905E 00	8.648E 00	2.483E 01	6.971E 01	1.974E 02	5.719E 02	1.686E 03
21500	1.000E-01	3.121E-01	9.721E-01	3.001E 00	8.999E 00	2.603E 01	7.301E 01	2.061E 02	5.952E 02	1.743E 03
22000	1.026E-01	3.201E-01	9.983E-01	3.097E 00	9.351E 00	2.728E 01	7.641E 01	2.152E 02	6.194E 02	1.802E 03
22500	1.052E-01	3.281E-01	1.024E-01	3.193E 00	9.704E 00	2.858E 01	8.000E 01	2.247E 02	6.446E 02	1.862E 03
23000	1.078E-01	3.361E-01	1.050E-01	3.289E 00	1.005E 01	3.000E 01	8.368E 01	2.346E 02	6.708E 02	1.924E 03
23500	1.104E-01	3.441E-01	1.076E-01	3.385E 00	1.040E 01	3.155E 01	8.746E 01	2.449E 02	6.979E 02	1.988E 03
24000	1.130E-01	3.521E-01	1.102E-01	3.481E 00	1.075E 01	3.315E 01	9.134E 01	2.556E 02	7.259E 02	2.054E 03
24500	1.156E-01	3.601E-01	1.128E-01	3.577E 00	1.110E 01	3.480E 01	9.534E 01	2.668E 02	7.560E 02	2.122E 03
25000	1.182E-01	3.681E-01	1.154E-01	3.673E 00	1.145E 01	3.650E 01	9.946E 01	2.784E 02	7.872E 02	2.192E 03
25500	1.208E-01	3.761E-01	1.180E-01	3.769E 00	1.180E 01	3.825E 01	1.037E 02	2.904E 02	8.194E 02	2.264E 03
26000	1.234E-01	3.841E-01	1.206E-01	3.865E 00	1.215E 01	4.005E 01	1.080E 02	3.029E 02	8.526E 02	2.338E 03
26500	1.260E-01	3.921E-01	1.232E-01	3.961E 00	1.250E 01	4.190E 01	1.124E 02	3.159E 02	8.868E 02	2.414E 03
27000	1.286E-01	4.001E-01	1.258E-01	4.057E 00	1.285E 01	4.380E 01	1.170E 02	3.294E 02	9.219E 02	2.492E 03
27500	1.312E-01	4.081E-01	1.284E-01	4.153E 00	1.320E 01	4.575E 01	1.218E 02	3.434E 02	9.579E 02	2.572E 03
28000	1.338E-01	4.161E-01	1.310E-01	4.249E 00	1.355E 01	4.775E 01	1.268E 02	3.579E 02	9.949E 02	2.654E 03
28500	1.364E-01	4.241E-01	1.336E-01	4.345E 00	1.390E 01	4.980E 01	1.319E 02	3.729E 02	1.032E 03	2.738E 03
29000	1.390E-01	4.321E-01	1.362E-01	4.441E 00	1.425E 01	5.190E 01	1.372E 02	3.884E 02	1.066E 03	2.826E 03
29500	1.416E-01	4.401E-01	1.388E-01	4.537E 00	1.460E 01	5.405E 01	1.426E 02	4.044E 02	1.101E 03	2.916E 03
30000	1.442E-01	4.481E-01	1.414E-01	4.633E 00	1.495E 01	5.625E 01	1.482E 02	4.209E 02	1.136E 03	3.008E 03
30500	1.468E-01	4.561E-01	1.440E-01	4.729E 00	1.530E 01	5.850E 01	1.539E 02	4.379E 02	1.171E 03	3.102E 03
31000	1.494E-01	4.641E-01	1.466E-01	4.825E 00	1.565E 01	6.080E 01	1.598E 02	4.554E 02	1.206E 03	3.198E 03
31500	1.520E-01	4.721E-01	1.492E-01	4.921E 00	1.600E 01	6.315E 01	1.658E 02	4.734E 02	1.241E 03	3.296E 03
32000	1.546E-01	4.801E-01	1.518E-01	5.017E 00	1.635E 01	6.555E 01	1.719E 02	4.919E 02	1.276E 03	3.396E 03
32500	1.572E-01	4.881E-01	1.544E-01	5.113E 00	1.670E 01	6.800E 01	1.781E 02	5.109E 02	1.311E 03	3.498E 03
33000	1.598E-01	4.961E-01	1.570E-01	5.209E 00	1.705E 01	7.050E 01	1.844E 02	5.304E 02	1.346E 03	3.602E 03
33500	1.624E-01	5.041E-01	1.596E-01	5.305E 00	1.740E 01	7.305E 01	1.909E 02	5.504E 02	1.381E 03	3.708E 03
34000	1.650E-01	5.121E-01	1.622E-01	5.401E 00	1.775E 01	7.565E 01	1.975E 02	5.709E 02	1.416E 03	3.816E 03
34500	1.676E-01	5.201E-01	1.648E-01	5.497E 00	1.810E 01	7.830E 01	2.042E 02	5.919E 02	1.451E 03	3.926E 03
35000	1.702E-01	5.281E-01	1.674E-01	5.593E 00	1.845E 01	8.100E 01	2.110E 02	6.134E 02	1.486E 03	4.038E 03
35500	1.728E-01	5.361E-01	1.700E-01	5.689E 00	1.880E 01	8.375E 01	2.179E 02	6.354E 02	1.521E 03	4.152E 03
36000	1.754E-01	5.441E-01	1.726E-01	5.785E 00	1.915E 01	8.655E 01	2.249E 02	6.579E 02	1.556E 03	4.268E 03
36500	1.780E-01	5.521E-01	1.752E-01	5.881E 00	1.950E 01	8.940E 01	2.320E 02	6.809E 02	1.591E 03	4.386E 03
37000	1.806E-01	5.601E-01	1.778E-01	5.977E 00	1.985E 01	9.230E 01	2.392E 02	7.044E 02	1.626E 03	4.506E 03
37500	1.832E-01	5.681E-01	1.804E-01	6.073E 00	2.020E 01	9.525E 01	2.465E 02	7.284E 02	1.661E 03	4.628E 03
38000	1.858E-01	5.761E-01	1.830E-01	6.169E 00	2.055E 01	9.825E 01	2.539E 02	7.529E 02	1.696E 03	4.752E 03
38500	1.884E-01	5.841E-01	1.856E-01	6.265E 00	2.090E 01	1.013E 02	2.614E 02	7.779E 02	1.731E 03	4.878E 03
39000	1.910E-01	5.921E-01	1.882E-01	6.361E 00	2.125E 01	1.043E 02	2.690E 02	8.034E 02	1.766E 03	4.998E 03
39500	1.936E-01	6.001E-01	1.908E-01	6.457E 00	2.160E 01	1.073E 02	2.766E 02	8.294E 02	1.801E 03	5.120E 03
40000	1.962E-01	6.081E-01	1.934E-01	6.553E 00	2.195E 01	1.103E 02	2.842E 02	8.559E 02	1.836E 03	5.244E 03
40500	1.988E-01	6.161E-01	1.960E-01	6.649E 00	2.230E 01	1.133E 02	2.920E 02	8.829E 02	1.871E 03	5.368E 03
41000	2.014E-01	6.241E-01	1.986E-01	6.745E 00	2.265E 01	1.163E 02	3.000E 02	9.104E 02	1.906E 03	5.494E 03
41500	2.040E-01	6.321E-01	2.012E-01	6.841E 00	2.300E 01	1.193E 02	3.080E 02	9.384E 02	1.941E 03	5.620E 03
42000	2.066E-01	6.401E-01	2.038E-01	6.937E 00	2.335E 01	1.223E 02	3.160E 02	9.669E 02	1.976E 03	5.748E 03
42500	2.092E-01	6.481E-01	2.064E-01	7.033E 00	2.370E 01	1.253E 02	3.240E 02	9.954E 02	2.011E 03	5.876E 03
43000	2.118E-01	6.561E-01	2.090E-01	7.129E 00	2.405E 01	1.283E 02	3.320E 02	1.023E 03	2.046E 03	6.006E 03
43500	2.144E-01	6.641E-01	2.116E-01	7.225E 00	2.440E 01	1.313E 02	3.400E 02	1.055E 03	2.081E 03	6.138E 03
44000	2.170E-01	6.721E-01	2.142E-01	7.321E 00	2.475E 01	1.343E 02	3.480E 02	1.087E 03	2.116E 03	6.272E 03
44500	2.196E-01	6.801E-01	2.168E-01	7.417E 00	2.510E 01	1.373E 02	3.560E 02	1.119E 03	2.151E 03	6.408E 03
45000	2.222E-01	6.881E-01	2.194E-01	7.513E 00	2.545E 01	1.403E 02	3.640E 02	1.151E 03	2.186E 03	6.544E 03
45500	2.248E-01	6.961E-01	2.220E-01	7.609E 00	2.580E 01	1.433E 02	3.720E 02	1.183E 03	2.221E 03	6.680E 03
46000	2.274E-01	7.041E-01	2.246E-01	7.705E 00	2.615E 01	1.463E 02	3.800E 02	1.215E 03	2.256E 03	6.816E 03
46500	2.300E-01	7.121E-01	2.272E-01	7.801E 00	2.650E 01	1.493E 02	3.880E 02	1.247E 03	2.291E 03	6.952E 03
47000	2.326E-01	7.201E-01	2.298E-01	7.897E 00	2.685E 01	1.523E 02	3.960E 02	1.279E 03	2.326E 03	7.088E 03
47500	2.352E-01	7.281E-01	2.324E-01	7.993E 00	2.720E 01	1.553E 02	4.040E 02	1.311E 03	2.361E 03	7.224E 03
48000	2.378E-01	7.361E-01	2.350E-01	8.089E 00	2.755E 01	1.583E 02	4.120E 02	1.343E 03	2.396E 03	7.360E 03
48500	2.404E-01	7.441E-01	2.376E-01	8.185E 00	2.790E 01	1.613E 02	4.200E 02	1.375E 03	2.431E 03	7.496E 03
49000	2.430E-01	7.521E-01	2.402E-01	8.281E 00	2.825E 01	1.643E 02	4.280E 02	1.		

200000	2.861E 00	9.026E 00	2.840E 01	8.897E 01	2.761E 02	8.437E 02	2.523E 03	7.354E 03	2.088E 04	5.773E 04
300000	4.306E 00	1.359E 01	4.285E 01	1.349E 02	4.236E 02	1.322E 03	4.081E 03	1.238E 04	3.661E 04	1.050E 05
400000	6.293E 00	1.925E 01	5.896E 01	1.827E 02	5.708E 02	1.785E 03	5.558E 03	1.713E 04	5.185E 04	1.330E 05
500000	8.752E 00	2.662E 01	8.135E 01	2.493E 02	7.595E 02	2.314E 03	7.104E 03	2.189E 04	6.687E 04	2.004E 05
600000	1.114E 01	3.468E 01	1.069E 02	3.250E 02	9.853E 02	2.995E 03	9.065E 03	2.737E 04	8.279E 04	2.492E 05
800000	1.520E 01	4.797E 01	1.510E 02	4.726E 02	1.469E 03	4.517E 03	1.369E 04	4.104E 04	1.225E 05	3.629E 05
1000000	1.901E 01	6.010E 01	1.899E 02	5.992E 02	1.886E 03	5.903E 03	1.830E 04	5.594E 04	1.681E 05	4.977E 05
1500000	2.853E 01	9.019E 01	2.851E 02	9.011E 02	2.846E 03	8.981E 03	2.828E 04	8.870E 04	2.760E 05	8.465E 05
2000000	3.804E 01	1.203E 02	3.803E 02	1.202E 03	3.798E 03	1.200E 04	3.785E 04	1.192E 05	3.732E 05	1.164E 06
3000000	5.712E 01	1.804E 02	5.709E 02	1.804E 03	5.703E 03	1.802E 04	5.691E 04	1.796E 05	5.655E 05	1.775E 06
4000000	7.617E 01	2.409E 02	7.616E 02	2.408E 03	7.613E 03	2.404E 04	7.600E 04	2.399E 05	7.566E 05	2.381E 06
5000000	9.522E 01	3.011E 02	9.521E 02	3.010E 03	9.518E 03	3.009E 04	9.509E 04	3.004E 05	9.479E 05	2.987E 06
6000000	1.143E 02	3.613E 02	1.143E 03	3.613E 03	1.142E 04	3.611E 04	1.142E 05	3.607E 05	1.139E 06	3.592E 06
8000000	1.524E 02	4.818E 02	1.523E 03	4.817E 03	1.523E 04	4.816E 04	1.523E 05	4.812E 05	1.520E 06	4.800E 06
10000000	1.904E 02	6.022E 02	1.904E 03	6.022E 03	1.904E 04	6.021E 04	1.904E 05	6.017E 05	1.902E 06	6.006E 06

TABLE 104. LOG OF PRESSURE (ATM) OF EQUILIBRIUM AIR

TEMP. (DEG K)	-9.0	-8.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.5	-5.0	-4.5	-4.0
10000	-6.836E 00	-6.336E 00	-5.837E 00	-5.337E 00	-4.839E 00	-4.345E 00	-3.860E 00	-3.391E 00	-2.940E 00	-2.495E 00	-2.042E 00
10500	-6.815E 00	-6.315E 00	-5.815E 00	-5.316E 00	-4.816E 00	-4.319E 00	-3.822E 00	-3.345E 00	-2.882E 00	-2.433E 00	-1.987E 00
11000	-6.795E 00	-6.295E 00	-5.795E 00	-5.295E 00	-4.796E 00	-4.297E 00	-3.800E 00	-3.311E 00	-2.835E 00	-2.377E 00	-1.931E 00
11500	-6.774E 00	-6.275E 00	-5.776E 00	-5.276E 00	-4.776E 00	-4.277E 00	-3.779E 00	-3.284E 00	-2.799E 00	-2.330E 00	-1.878E 00
12000	-6.752E 00	-6.256E 00	-5.757E 00	-5.257E 00	-4.757E 00	-4.258E 00	-3.759E 00	-3.262E 00	-2.770E 00	-2.291E 00	-1.830E 00
12500	-6.726E 00	-6.235E 00	-5.730E 00	-5.239E 00	-4.739E 00	-4.240E 00	-3.740E 00	-3.242E 00	-2.747E 00	-2.261E 00	-1.790E 00
13000	-6.699E 00	-6.209E 00	-5.718E 00	-5.221E 00	-4.722E 00	-4.222E 00	-3.723E 00	-3.224E 00	-2.727E 00	-2.236E 00	-1.757E 00
13500	-6.666E 00	-6.176E 00	-5.694E 00	-5.202E 00	-4.705E 00	-4.206E 00	-3.706E 00	-3.207E 00	-2.709E 00	-2.215E 00	-1.729E 00
14000	-6.600E 00	-6.136E 00	-5.665E 00	-5.180E 00	-4.682E 00	-4.189E 00	-3.690E 00	-3.191E 00	-2.692E 00	-2.196E 00	-1.704E 00
14500	-6.559E 00	-6.092E 00	-5.628E 00	-5.154E 00	-4.667E 00	-4.172E 00	-3.674E 00	-3.175E 00	-2.676E 00	-2.179E 00	-1.686E 00
15000	-6.525E 00	-6.052E 00	-5.588E 00	-5.122E 00	-4.644E 00	-4.154E 00	-3.656E 00	-3.140E 00	-2.641E 00	-2.163E 00	-1.668E 00
15500	-6.497E 00	-6.018E 00	-5.548E 00	-5.085E 00	-4.616E 00	-4.134E 00	-3.642E 00	-3.145E 00	-2.646E 00	-2.148E 00	-1.652E 00
16000	-6.472E 00	-5.989E 00	-5.513E 00	-5.047E 00	-4.584E 00	-4.110E 00	-3.624E 00	-3.130E 00	-2.632E 00	-2.134E 00	-1.637E 00
16500	-6.452E 00	-5.964E 00	-5.483E 00	-5.012E 00	-4.549E 00	-4.082E 00	-3.604E 00	-3.114E 00	-2.616E 00	-2.120E 00	-1.622E 00
17000	-6.435E 00	-5.942E 00	-5.457E 00	-4.981E 00	-4.514E 00	-4.052E 00	-3.580E 00	-3.096E 00	-2.603E 00	-2.106E 00	-1.608E 00
17500	-6.420E 00	-5.924E 00	-5.435E 00	-4.954E 00	-4.482E 00	-4.019E 00	-3.554E 00	-3.077E 00	-2.586E 00	-2.092E 00	-1.595E 00
18000	-6.406E 00	-5.909E 00	-5.416E 00	-4.930E 00	-4.454E 00	-3.987E 00	-3.525E 00	-3.055E 00	-2.571E 00	-2.078E 00	-1.582E 00
18500	-6.393E 00	-5.895E 00	-5.400E 00	-4.910E 00	-4.429E 00	-3.958E 00	-3.495E 00	-3.030E 00	-2.553E 00	-2.064E 00	-1.569E 00
19000	-6.381E 00	-5.882E 00	-5.385E 00	-4.892E 00	-4.407E 00	-3.931E 00	-3.468E 00	-3.004E 00	-2.533E 00	-2.048E 00	-1.556E 00
19500	-6.369E 00	-5.870E 00	-5.372E 00	-4.877E 00	-4.387E 00	-3.907E 00	-3.438E 00	-2.974E 00	-2.510E 00	-2.032E 00	-1.542E 00
20000	-6.356E 00	-5.856E 00	-5.360E 00	-4.863E 00	-4.371E 00	-3.886E 00	-3.413E 00	-2.949E 00	-2.486E 00	-2.014E 00	-1.528E 00
22000	-6.290E 00	-5.806E 00	-5.314E 00	-4.817E 00	-4.319E 00	-3.824E 00	-3.335E 00	-2.856E 00	-2.388E 00	-1.928E 00	-1.461E 00
24000	-6.200E 00	-5.727E 00	-5.253E 00	-4.769E 00	-4.270E 00	-3.780E 00	-3.284E 00	-2.793E 00	-2.311E 00	-1.841E 00	-1.380E 00
26000	-6.134E 00	-5.650E 00	-5.173E 00	-4.702E 00	-4.223E 00	-3.738E 00	-3.244E 00	-2.746E 00	-2.256E 00	-1.773E 00	-1.303E 00
28000	-6.091E 00	-5.596E 00	-5.108E 00	-4.629E 00	-4.157E 00	-3.684E 00	-3.201E 00	-2.712E 00	-2.216E 00	-1.725E 00	-1.243E 00
30000	-6.056E 00	-5.559E 00	-5.064E 00	-4.574E 00	-4.092E 00	-3.619E 00	-3.147E 00	-2.668E 00	-2.179E 00	-1.687E 00	-1.197E 00
32000	-6.018E 00	-5.524E 00	-5.030E 00	-4.534E 00	-4.043E 00	-3.561E 00	-3.087E 00	-2.612E 00	-2.122E 00	-1.631E 00	-1.140E 00
34000	-5.985E 00	-5.485E 00	-4.997E 00	-4.503E 00	-4.008E 00	-3.516E 00	-3.034E 00	-2.561E 00	-2.090E 00	-1.613E 00	-1.126E 00
36000	-5.911E 00	-5.433E 00	-4.935E 00	-4.469E 00	-3.977E 00	-3.483E 00	-2.993E 00	-2.511E 00	-2.035E 00	-1.569E 00	-1.091E 00
38000	-5.869E 00	-5.384E 00	-4.905E 00	-4.428E 00	-3.944E 00	-3.453E 00	-2.960E 00	-2.472E 00	-1.992E 00	-1.522E 00	-1.051E 00
40000	-5.838E 00	-5.344E 00	-4.860E 00	-4.391E 00	-3.904E 00	-3.421E 00	-2.931E 00	-2.440E 00	-1.953E 00	-1.477E 00	-1.008E 00
42000	-5.807E 00	-5.314E 00	-4.825E 00	-4.353E 00	-3.861E 00	-3.384E 00	-2.901E 00	-2.412E 00	-1.922E 00	-1.439E 00	-0.961E-01
44000	-5.772E 00	-5.286E 00	-4.796E 00	-4.303E 00	-3.821E 00	-3.344E 00	-2.867E 00	-2.383E 00	-1.894E 00	-1.407E 00	-0.928E-01
46000	-5.735E 00	-5.253E 00	-4.767E 00	-4.277E 00	-3.788E 00	-3.306E 00	-2.829E 00	-2.352E 00	-1.867E 00	-1.379E 00	-0.895E-01
48000	-5.701E 00	-5.217E 00	-4.736E 00	-4.250E 00	-3.760E 00	-3.273E 00	-2.793E 00	-2.317E 00	-1.838E 00	-1.353E 00	-0.871E-01
50000	-5.673E 00	-5.189E 00	-4.702E 00	-4.220E 00	-3.734E 00	-3.246E 00	-2.761E 00	-2.283E 00	-1.807E 00	-1.327E 00	-0.844E-01
60000	-5.578E 00	-5.080E 00	-4.583E 00	-4.088E 00	-3.598E 00	-3.114E 00	-2.634E 00	-2.153E 00	-1.667E 00	-1.186E 00	-0.710E-01
70000	-5.499E 00	-5.001E 00	-4.505E 00	-4.009E 00	-3.513E 00	-3.017E 00	-2.524E 00	-2.037E 00	-1.557E 00	-1.078E 00	-0.5976E-01
80000	-5.440E 00	-4.940E 00	-4.441E 00	-3.942E 00	-3.445E 00	-2.949E 00	-2.454E 00	-1.959E 00	-1.467E 00	-0.9813E-01	-0.5027E-01

90000	-5.309E 00	-4.809E 00	-4.309E 00	-3.809E 00	-3.309E 00	-2.809E 00	-2.309E 00	-1.809E 00	-1.409E 00	-9.105E-01	-4.221E-01
100000	-5.343E 00	-4.843E 00	-4.343E 00	-3.843E 00	-3.343E 00	-2.843E 00	-2.343E 00	-1.843E 00	-1.350E 00	-8.555E-01	-3.627E-01
150000	-5.167E 00	-4.667E 00	-4.167E 00	-3.667E 00	-3.167E 00	-2.667E 00	-2.167E 00	-1.667E 00	-1.107E 00	-6.470E-01	-1.605E-01
200000	-5.040E 00	-4.540E 00	-4.042E 00	-3.542E 00	-3.042E 00	-2.542E 00	-2.042E 00	-1.542E 00	-1.042E 00	-5.420E-01	-4.280E-02
300000	-4.703E 00	-4.277E 00	-3.792E 00	-3.304E 00	-2.812E 00	-2.310E 00	-1.827E 00	-1.340E 00	-8.533E-01	-3.411E-01	1.350E-01
400000	-4.619E 00	-4.121E 00	-3.623E 00	-3.127E 00	-2.630E 00	-2.133E 00	-1.639E 00	-1.150E 00	-6.601E-01	-1.801E-01	3.090E-01
500000	-4.522E 00	-4.022E 00	-3.522E 00	-3.022E 00	-2.522E 00	-2.023E 00	-1.524E 00	-1.028E 00	-5.317E-01	-3.641E-02	4.550E-01
600000	-4.443E 00	-3.943E 00	-3.443E 00	-2.943E 00	-2.443E 00	-1.943E 00	-1.443E 00	-9.429E-01	-4.435E-01	5.400E-02	5.510E-01
800000	-4.310E 00	-3.810E 00	-3.310E 00	-2.810E 00	-2.310E 00	-1.810E 00	-1.310E 00	-8.177E-01	-3.177E-01	1.822E-01	6.021E-01
1000000	-4.221E 00	-3.721E 00	-3.221E 00	-2.721E 00	-2.221E 00	-1.721E 00	-1.221E 00	-7.200E-01	-2.200E-01	2.792E-01	7.792E-01
1500000	-4.045E 00	-3.545E 00	-3.045E 00	-2.545E 00	-2.045E 00	-1.545E 00	-1.045E 00	-5.440E-01	-4.440E-02	4.533E-01	9.533E-01
2000000	-3.919E 00	-3.419E 00	-2.919E 00	-2.419E 00	-1.919E 00	-1.419E 00	-9.195E-01	-4.196E-01	8.035E-02	5.803E-01	1.000E 00
3000000	-3.743E 00	-3.243E 00	-2.743E 00	-2.243E 00	-1.743E 00	-1.243E 00	-7.431E-01	-2.431E-01	2.549E-01	7.549E-01	1.257E 00
4000000	-3.610E 00	-3.110E 00	-2.610E 00	-2.110E 00	-1.610E 00	-1.110E 00	-6.102E-01	-1.102E-01	3.810E-01	8.810E-01	1.302E 00
5000000	-3.521E 00	-3.021E 00	-2.521E 00	-2.021E 00	-1.521E 00	-1.021E 00	-5.213E-01	-2.127E-02	4.787E-01	9.787E-01	1.479E 00
6000000	-3.442E 00	-2.942E 00	-2.442E 00	-1.942E 00	-1.442E 00	-9.421E-01	-4.421E-01	5.791E-02	5.791E-02	1.030E 00	1.950E 00
8000000	-3.317E 00	-2.817E 00	-2.317E 00	-1.817E 00	-1.317E 00	-8.171E-01	-3.171E-01	1.829E-01	4.829E-01	1.103E 00	1.403E 00
10000000	-3.220E 00	-2.720E 00	-2.220E 00	-1.720E 00	-1.220E 00	-7.202E-01	-2.202E-01	2.790E-01	7.790E-01	1.290E 00	1.790E 00

TABLE 104(CONT): LOG OF PRESSURE (ATM) OF EQUILIBRIUM AIR

TEMP. (DEG K)	-3.5	-3.0	-2.5	LOG DENSITY RATIO	-1.5	-1.0	-0.5	0.0	0.5	1.0
1000	-1.570E 00	-1.102E 00	-6.169E-01	-1.264E-01	3.663E-01	0.571E-01	1.340E 00	1.808E 00	2.267E 00	2.725E 00
1050	-1.532E 00	-1.064E 00	-5.852E-01	-9.843E-02	3.924E-01	0.841E-01	1.371E 00	1.847E 00	2.309E 00	2.766E 00
1100	-1.482E 00	-1.025E 00	-5.517E-01	-7.007E-02	4.181E-01	9.093E-01	1.399E 00	1.880E 00	2.347E 00	2.805E 00
1150	-1.432E 00	-9.800E-01	-5.140E-01	-4.033E-02	4.441E-01	9.335E-01	1.424E 00	1.909E 00	2.381E 00	2.842E 00
1200	-1.383E 00	-9.353E-01	-4.785E-01	-9.232E-03	4.706E-01	9.574E-01	1.447E 00	1.934E 00	2.412E 00	2.876E 00
1250	-1.337E 00	-8.906E-01	-4.395E-01	2.323E-02	4.978E-01	9.813E-01	1.470E 00	1.958E 00	2.439E 00	2.908E 00
1300	-1.295E 00	-8.473E-01	-3.999E-01	5.687E-02	5.260E-01	1.006E 00	1.492E 00	1.980E 00	2.464E 00	2.936E 00
1350	-1.260E 00	-8.068E-01	-3.604E-01	9.132E-02	5.549E-01	1.030E 00	1.514E 00	2.001E 00	2.487E 00	2.963E 00
1400	-1.229E 00	-7.698E-01	-3.223E-01	1.261E-01	5.846E-01	1.055E 00	1.536E 00	2.022E 00	2.508E 00	2.987E 00
1450	-1.203E 00	-7.368E-01	-2.861E-01	1.607E-01	6.147E-01	1.081E 00	1.558E 00	2.042E 00	2.528E 00	3.009E 00
1500	-1.181E 00	-7.079E-01	-2.523E-01	1.945E-01	6.451E-01	1.107E 00	1.580E 00	2.062E 00	2.547E 00	3.030E 00
1550	-1.161E 00	-6.826E-01	-2.215E-01	2.279E-01	6.753E-01	1.133E 00	1.602E 00	2.081E 00	2.566E 00	3.049E 00
1600	-1.144E 00	-6.605E-01	-1.937E-01	2.578E-01	7.051E-01	1.159E 00	1.625E 00	2.101E 00	2.584E 00	3.068E 00
1650	-1.128E 00	-6.408E-01	-1.687E-01	2.868E-01	7.341E-01	1.185E 00	1.647E 00	2.121E 00	2.602E 00	3.085E 00
1700	-1.113E 00	-6.232E-01	-1.464E-01	3.135E-01	7.621E-01	1.211E 00	1.670E 00	2.140E 00	2.620E 00	3.103E 00
1750	-1.099E 00	-6.072E-01	-1.263E-01	3.381E-01	7.888E-01	1.237E 00	1.693E 00	2.160E 00	2.637E 00	3.119E 00
1800	-1.085E 00	-5.923E-01	-1.082E-01	3.604E-01	8.141E-01	1.262E 00	1.715E 00	2.180E 00	2.655E 00	3.135E 00
1850	-1.072E 00	-5.784E-01	-9.170E-02	3.812E-01	8.379E-01	1.286E 00	1.738E 00	2.199E 00	2.672E 00	3.151E 00
1900	-1.060E 00	-5.653E-01	-7.648E-02	4.000E-01	8.602E-01	1.310E 00	1.760E 00	2.219E 00	2.689E 00	3.167E 00
1950	-1.048E 00	-5.524E-01	-6.229E-02	4.173E-01	8.810E-01	1.332E 00	1.781E 00	2.238E 00	2.706E 00	3.182E 00
2000	-1.035E 00	-5.404E-01	-4.895E-02	4.335E-01	9.003E-01	1.353E 00	1.802E 00	2.257E 00	2.723E 00	3.197E 00
2050	-9.821E-01	-4.930E-01	-3.161E-04	4.879E-01	9.056E-01	1.429E 00	1.880E 00	2.331E 00	2.789E 00	3.254E 00
2100	-9.167E-01	-4.415E-01	4.418E-02	5.330E-01	1.017E 00	1.469E 00	1.947E 00	2.398E 00	2.851E 00	3.311E 00
2150	-8.427E-01	-3.805E-01	9.273E-02	5.759E-01	1.061E 00	1.538E 00	2.003E 00	2.457E 00	2.908E 00	3.363E 00
2200	-7.738E-01	-3.141E-01	1.480E-01	6.208E-01	1.102E 00	1.581E 00	2.051E 00	2.510E 00	2.960E 00	3.411E 00
2250	-7.176E-01	-2.515E-01	2.073E-01	6.702E-01	1.143E 00	1.621E 00	2.094E 00	2.556E 00	3.004E 00	3.454E 00
2300	-6.736E-01	-1.982E-01	2.645E-01	7.228E-01	1.187E 00	1.659E 00	2.132E 00	2.597E 00	3.049E 00	3.497E 00
2350	-6.376E-01	-1.549E-01	3.152E-01	7.744E-01	1.233E 00	1.699E 00	2.169E 00	2.635E 00	3.088E 00	3.536E 00
2400	-6.049E-01	-1.190E-01	3.582E-01	8.224E-01	1.279E 00	1.739E 00	2.205E 00	2.671E 00	3.124E 00	3.572E 00
2450	-5.719E-01	-8.701E-02	3.946E-01	8.648E-01	1.324E 00	1.780E 00	2.241E 00	2.705E 00	3.159E 00	3.605E 00
2500	-5.361E-01	-5.605E-02	4.265E-01	9.019E-01	1.365E 00	1.820E 00	2.278E 00	2.738E 00	3.191E 00	3.637E 00
2550	-4.977E-01	-2.391E-02	4.563E-01	9.343E-01	1.402E 00	1.859E 00	2.314E 00	2.771E 00	3.222E 00	3.668E 00
2600	-4.587E-01	1.022E-02	4.858E-01	9.639E-01	1.435E 00	1.895E 00	2.349E 00	2.803E 00	3.253E 00	3.697E 00
2650	-4.219E-01	4.555E-02	5.162E-01	9.920E-01	1.465E 00	1.928E 00	2.383E 00	2.835E 00	3.283E 00	3.726E 00
2700	-3.887E-01	8.044E-02	5.476E-01	1.020E 00	1.493E 00	1.958E 00	2.415E 00	2.864E 00	3.312E 00	3.753E 00
2750	-3.593E-01	1.133E-01	5.796E-01	1.049E 00	1.520E 00	1.987E 00	2.445E 00	2.896E 00	3.341E 00	3.780E 00
2800	-3.369E-01	1.409E-01	6.179E-01	1.187E 00	1.549E 00	2.111E 00	2.572E 00	3.027E 00	3.472E 00	3.907E 00
2850	-3.190E-01	1.590E-01	6.243E-01	1.296E 00	1.764E 00	2.225E 00	2.681E 00	3.135E 00	3.582E 00	4.017E 00
2900	-2.594E-02	4.512E-01	9.241E-01	1.392E 00	1.856E 00	2.322E 00	2.779E 00	3.231E 00	3.677E 00	4.113E 00

96CC00	9.842E-02	9.335E-01	1.008E 00	1.478E 00	1.944E 00	2.405E 00	2.843E 00	3.314E 00	3.762E 00	4.197E 00
10CC00	1.262E-01	6.073E-01	1.081E 00	1.552E 00	2.020E 00	2.481E 00	2.938E 00	3.391E 00	3.838E 00	4.273E 00
150C00	3.300E-01	8.267E-01	1.320E 00	1.808E 00	2.289E 00	2.761E 00	3.223E 00	3.677E 00	4.125E 00	4.562E 00
250C00	4.546E-01	9.555E-01	1.453E 00	1.949E 00	2.441E 00	2.926E 00	3.402E 00	3.867E 00	4.320E 00	4.761E 00
36CC00	6.341E-01	1.133E 00	1.632E 00	2.130E 00	2.627E 00	3.121E 00	3.611E 00	4.093E 00	4.564E 00	5.021E 00
480C00	7.989E-01	1.284E 00	1.771E 00	2.262E 00	2.756E 00	3.252E 00	3.745E 00	4.234E 00	4.715E 00	5.185E 00
50CC00	9.421E-01	1.425E 00	1.910E 00	2.397E 00	2.881E 00	3.364E 00	3.852E 00	4.340E 00	4.825E 00	5.302E 00
60CC00	1.047E 00	1.540E 00	2.024E 00	2.512E 00	2.994E 00	3.476E 00	3.957E 00	4.437E 00	4.918E 00	5.396E 00
80CC00	1.102E 00	1.681E 00	2.179E 00	2.675E 00	3.167E 00	3.655E 00	4.136E 00	4.613E 00	5.088E 00	5.568E 00
100CC00	1.279E 00	1.779E 00	2.270E 00	2.770E 00	3.276E 00	3.771E 00	4.262E 00	4.748E 00	5.226E 00	5.697E 00
130CC00	1.459E 00	1.959E 00	2.459E 00	2.959E 00	3.454E 00	3.953E 00	4.451E 00	4.948E 00	5.441E 00	5.928E 00
260CC00	1.580E 00	2.080E 00	2.580E 00	3.080E 00	3.580E 00	4.079E 00	4.578E 00	5.076E 00	5.573E 00	6.068E 00
300CC00	1.757E 00	2.257E 00	2.757E 00	3.256E 00	3.756E 00	4.254E 00	4.753E 00	5.254E 00	5.752E 00	6.249E 00
400CC00	1.882E 00	2.382E 00	2.882E 00	3.382E 00	3.882E 00	4.381E 00	4.881E 00	5.380E 00	5.879E 00	6.377E 00
500CC00	1.979E 00	2.479E 00	2.979E 00	3.479E 00	3.979E 00	4.478E 00	4.978E 00	5.478E 00	5.977E 00	6.475E 00
6000000	2.058E 00	2.558E 00	3.058E 00	3.558E 00	4.058E 00	4.558E 00	5.057E 00	5.557E 00	6.056E 00	6.555E 00
8000000	2.183E 00	2.683E 00	3.183E 00	3.683E 00	4.183E 00	4.683E 00	5.183E 00	5.682E 00	6.182E 00	6.681E 00
10000000	2.280E 00	2.780E 00	3.280E 00	3.780E 00	4.280E 00	4.780E 00	5.280E 00	5.779E 00	6.279E 00	6.779E 00

TABLE 105. DIMENSIONLESS INTERNAL ENERGY, E/RT, OF EQUILIBRIUM AIR

TEMP. (DEG K)	-9.0	-8.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.5	-5.0	-4.5	-4.0
10000	4.954E 01	4.952E 01	4.949E 01	4.939E 01	4.908E 01	4.818E 01	4.583E 01	4.109E 01	3.444E 01	2.781E 01	2.262E 01
10500	4.752E 01	4.750E 01	4.749E 01	4.744E 01	4.731E 01	4.692E 01	4.580E 01	4.303E 01	3.792E 01	3.139E 01	2.534E 01
11000	4.576E 01	4.569E 01	4.566E 01	4.543E 01	4.557E 01	4.539E 01	4.486E 01	4.209E 01	4.003E 01	3.453E 01	2.827E 01
11500	4.436E 01	4.409E 01	4.401E 01	4.397E 01	4.393E 01	4.385E 01	4.358E 01	4.282E 01	4.083E 01	3.678E 01	3.102E 01
12000	4.372E 01	4.286E 01	4.256E 01	4.247E 01	4.242E 01	4.237E 01	4.223E 01	4.183E 01	4.069E 01	3.799E 01	3.327E 01
12500	4.466E 01	4.230E 01	4.144E 01	4.114E 01	4.104E 01	4.099E 01	4.091E 01	4.069E 01	4.004E 01	3.834E 01	3.481E 01
13000	4.818E 01	4.308E 01	4.090E 01	4.010E 01	3.982E 01	3.972E 01	3.945E 01	3.952E 01	3.914E 01	3.810E 01	3.562E 01
13500	5.431E 01	4.599E 01	4.143E 01	3.952E 01	3.882E 01	3.859E 01	3.849E 01	3.839E 01	3.816E 01	3.752E 01	3.585E 01
14000	6.131E 01	5.108E 01	4.363E 01	3.977E 01	3.819E 01	3.743E 01	3.743E 01	3.732E 01	3.717E 01	3.676E 01	3.566E 01
14500	6.711E 01	5.724E 01	4.769E 01	4.128E 01	3.816E 01	3.696E 01	3.651E 01	3.634E 01	3.621E 01	3.594E 01	3.520E 01
15000	7.103E 01	6.283E 01	5.293E 01	4.431E 01	3.904E 01	3.646E 01	3.578E 01	3.546E 01	3.530E 01	3.510E 01	3.460E 01
15500	7.356E 01	6.595E 01	5.818E 01	4.356E 01	4.113E 01	3.708E 01	3.534E 01	3.471E 01	3.447E 01	3.428E 01	3.393E 01
16000	7.502E 01	6.974E 01	6.246E 01	5.326E 01	4.435E 01	3.831E 01	3.533E 01	3.416E 01	3.373E 01	3.351E 01	3.324E 01
16500	7.539E 01	7.151E 01	6.557E 01	5.755E 01	4.828E 01	4.052E 01	3.593E 01	3.389E 01	3.311E 01	3.280E 01	3.255E 01
17000	7.484E 01	7.231E 01	6.768E 01	6.096E 01	5.230E 01	4.353E 01	3.725E 01	3.400E 01	3.268E 01	3.217E 01	3.190E 01
17500	7.374E 01	7.222E 01	6.892E 01	6.345E 01	5.586E 01	4.697E 01	3.930E 01	3.462E 01	3.248E 01	3.165E 01	3.129E 01
18000	7.239E 01	7.148E 01	6.934E 01	6.513E 01	5.871E 01	5.040E 01	4.194E 01	3.591E 01	3.260E 01	3.127E 01	3.074E 01
18500	7.099E 01	7.039E 01	6.906E 01	6.606E 01	6.083E 01	5.344E 01	4.488E 01	3.758E 01	3.312E 01	3.109E 01	3.028E 01
19000	6.967E 01	6.917E 01	6.831E 01	6.631E 01	6.227E 01	5.594E 01	4.781E 01	3.977E 01	3.408E 01	3.115E 01	2.993E 01
19500	6.852E 01	6.793E 01	6.731E 01	6.608E 01	6.304E 01	5.784E 01	5.048E 01	4.223E 01	3.547E 01	3.150E 01	2.973E 01
20000	6.769E 01	6.680E 01	6.623E 01	6.533E 01	6.329E 01	5.917E 01	5.275E 01	4.474E 01	3.722E 01	3.219E 01	2.970E 01
20500	6.699E 01	6.596E 01	6.548E 01	6.473E 01	6.299E 01	5.908E 01	5.219E 01	4.390E 01	3.633E 01	3.179E 01	2.947E 01
21000	6.625E 01	6.525E 01	6.488E 01	6.430E 01	6.287E 01	5.923E 01	5.222E 01	4.379E 01	3.610E 01	3.142E 01	2.912E 01
21500	6.550E 01	6.450E 01	6.423E 01	6.381E 01	6.266E 01	5.938E 01	5.214E 01	4.359E 01	3.587E 01	3.115E 01	2.885E 01
22000	6.476E 01	6.376E 01	6.358E 01	6.330E 01	6.240E 01	5.955E 01	5.209E 01	4.343E 01	3.561E 01	3.089E 01	2.859E 01
22500	6.402E 01	6.302E 01	6.284E 01	6.266E 01	6.196E 01	5.955E 01	5.193E 01	4.317E 01	3.525E 01	3.053E 01	2.823E 01
23000	6.328E 01	6.228E 01	6.210E 01	6.192E 01	6.142E 01	5.955E 01	5.179E 01	4.293E 01	3.501E 01	3.029E 01	2.799E 01
23500	6.254E 01	6.154E 01	6.136E 01	6.118E 01	6.088E 01	5.955E 01	5.167E 01	4.277E 01	3.485E 01	3.013E 01	2.783E 01
24000	6.180E 01	6.080E 01	6.062E 01	6.044E 01	6.036E 01	5.955E 01	5.149E 01	4.257E 01	3.465E 01	2.993E 01	2.763E 01
24500	6.106E 01	6.006E 01	5.988E 01	5.970E 01	5.982E 01	5.955E 01	5.143E 01	4.235E 01	3.453E 01	2.981E 01	2.753E 01
25000	6.032E 01	5.932E 01	5.914E 01	5.896E 01	5.908E 01	5.955E 01	5.131E 01	4.213E 01	3.431E 01	2.959E 01	2.735E 01
25500	5.958E 01	5.858E 01	5.840E 01	5.822E 01	5.854E 01	5.955E 01	5.109E 01	4.191E 01	3.409E 01	2.937E 01	2.713E 01
26000	5.884E 01	5.784E 01	5.766E 01	5.748E 01	5.780E 01	5.955E 01	5.087E 01	4.169E 01	3.387E 01	2.915E 01	2.689E 01
26500	5.810E 01	5.710E 01	5.692E 01	5.674E 01	5.706E 01	5.955E 01	5.065E 01	4.147E 01	3.365E 01	2.893E 01	2.667E 01
27000	5.736E 01	5.636E 01	5.618E 01	5.600E 01	5.632E 01	5.955E 01	5.043E 01	4.125E 01	3.343E 01	2.871E 01	2.645E 01
27500	5.662E 01	5.562E 01	5.544E 01	5.526E 01	5.558E 01	5.955E 01	5.021E 01	4.103E 01	3.321E 01	2.849E 01	2.623E 01
28000	5.588E 01	5.488E 01	5.470E 01	5.452E 01	5.484E 01	5.955E 01	5.000E 01	4.081E 01	3.299E 01	2.827E 01	2.601E 01
28500	5.514E 01	5.414E 01	5.396E 01	5.378E 01	5.410E 01	5.955E 01	4.978E 01	4.059E 01	3.277E 01	2.805E 01	2.579E 01
29000	5.440E 01	5.340E 01	5.322E 01	5.304E 01	5.336E 01	5.955E 01	4.956E 01	4.037E 01	3.255E 01	2.783E 01	2.557E 01
29500	5.366E 01	5.266E 01	5.248E 01	5.230E 01	5.262E 01	5.955E 01	4.934E 01	4.015E 01	3.233E 01	2.761E 01	2.535E 01
30000	5.292E 01	5.192E 01	5.174E 01	5.156E 01	5.188E 01	5.955E 01	4.912E 01	4.000E 01	3.211E 01	2.739E 01	2.513E 01
30500	5.218E 01	5.118E 01	5.100E 01	5.082E 01	5.114E 01	5.955E 01	4.890E 01	3.978E 01	3.189E 01	2.717E 01	2.491E 01
31000	5.144E 01	5.044E 01	5.026E 01	5.008E 01	5.040E 01	5.955E 01	4.868E 01	3.956E 01	3.167E 01	2.695E 01	2.469E 01
31500	5.070E 01	4.970E 01	4.952E 01	4.934E 01	4.966E 01	5.955E 01	4.846E 01	3.934E 01	3.145E 01	2.673E 01	2.447E 01
32000	5.000E 01	4.900E 01	4.882E 01	4.864E 01	4.896E 01	5.955E 01	4.824E 01	3.912E 01	3.123E 01	2.651E 01	2.425E 01
32500	4.926E 01	4.826E 01	4.808E 01	4.790E 01	4.822E 01	5.955E 01	4.802E 01	3.890E 01	3.101E 01	2.629E 01	2.403E 01
33000	4.852E 01	4.752E 01	4.734E 01	4.716E 01	4.748E 01	5.955E 01	4.780E 01	3.868E 01	3.079E 01	2.607E 01	2.381E 01
33500	4.778E 01	4.678E 01	4.660E 01	4.642E 01	4.674E 01	5.955E 01	4.758E 01	3.846E 01	3.057E 01	2.585E 01	2.359E 01
34000	4.704E 01	4.604E 01	4.586E 01	4.568E 01	4.599E 01	5.955E 01	4.736E 01	3.824E 01	3.035E 01	2.563E 01	2.337E 01
34500	4.630E 01	4.530E 01	4.512E 01	4.494E 01	4.526E 01	5.955E 01	4.714E 01	3.802E 01	3.013E 01	2.541E 01	2.315E 01
35000	4.556E 01	4.456E 01	4.438E 01	4.420E 01	4.452E 01	5.955E 01	4.692E 01	3.780E 01	2.991E 01	2.519E 01	2.293E 01
35500	4.482E 01	4.382E 01	4.364E 01	4.346E 01	4.378E 01	5.955E 01	4.670E 01	3.758E 01	2.969E 01	2.497E 01	2.271E 01
36000	4.408E 01	4.308E 01	4.290E 01	4.272E 01	4.304E 01	5.955E 01	4.648E 01	3.736E 01	2.947E 01	2.475E 01	2.249E 01
36500	4.334E 01	4.234E 01	4.216E 01	4.198E 01	4.230E 01	5.955E 01	4.626E 01	3.714E 01	2.925E 01	2.453E 01	2.227E 01
37000	4.260E 01	4.160E 01	4.142E 01	4.124E 01	4.156E 01	5.955E 01	4.604E 01	3.692E 01	2.903E 01	2.431E 01	2.205E 01
37500	4.186E 01	4.086E 01	4.068E 01	4.050E 01	4.082E 01	5.955E 01	4.582E 01	3.670E 01	2.881E 01	2.409E 01	2.183E 01
38000	4.112E 01	4.012E 01	3.994E 01	3.976E 01	4.008E 01	5.955E 01	4.560E 01	3.648E 01	2.859E 01	2.387E 01	2.161E 01
38500	4.038E 01	3.938E 01	3.920E 01	3.902E 01	3.934E 01	5.955E 01	4.538E 01	3.626E 01	2.837E 01	2.365E 01	2.139E 01
39000	3.964E 01	3.864E 01	3.846E 01	3.828E 01	3.860E 01	5.955E 01	4.516E 01	3.604E 01	2.815E 01	2.343E 01	2.117E 01
39500	3.890E 01	3.790E 01	3.772E 01	3.754E 01	3.786E 01	5.955E 01	4.494E 01	3.582E 01	2.793E 01	2.321E 01	2.095E 01
40000	3.816E 01	3.716E 01	3.698E 01	3.680E 01	3.712E 01	5.955E 01	4.472E 01	3.560E 01	2.771E 01	2.299E 01	2.073E 01
40500	3.742E 01	3.642E 01	3.624E 01	3.606E 01	3.638E 01	5.955E 01	4.450E 01	3.538E 01	2.749E 01	2.277E 01	2.051E 01
41000	3.668E 01	3.568E 01	3.550E 01	3.532E 01	3.564E 01	5.955E 01	4.428E 01	3.516E 01	2.727E 01	2.255E 01	2.029E 01
41500	3.594E 01	3.494E 01	3.476E 01	3.458E 01	3.490E 01	5.955E 01	4.406E 01	3.494E 01	2.705E 01	2.233E 01	2.007E 01
42000	3.520E 01	3.420E 01	3.402E 01	3.384E 01	3.416E 01	5.955E 01	4.384E 01	3.472E 01	2.683E 01	2.211E 01	1.985E 01
42500	3.446E 01	3.346E 01	3.328E 01	3.310E 01	3.342E 01	5.955E 01	4.362E 01	3.450E 01	2.661E 01	2.189E 01	1.963E 01
43000	3.372E 01	3.272E 01	3.254E 01	3.236E 01	3.268E 01	5.955E 01	4.340E 01	3.428E 01	2.639E 01	2.167E 01	1.941E 01
43500	3.298E 01	3.198E 01	3.180E 01	3.162E 01	3.194E 01	5.955E 01	4.318E 01	3.406E 01	2.617E 01	2.145E 01	1.919E 01
44000	3.224E 01	3.124E 01	3.106E 01	3.088E 01	3.120E 01	5.955E 01	4.296E 01	3.384E 01	2.595E 01	2.123E 01	1.897E 01
44500	3.150E 01	3.050E 01	3.032E 01	3.014E 01	3.046E 01	5.955E 01	4.274E 01	3.362E 01	2.573E 01	2.101E 01	1.875E 01
45000	3.076E 01	2.976E 01	2.958E 01	2.940E 01	2.972E 01	5.955E 01	4.252E 01	3.340E 01	2.551E 01	2.079E 01	1.853E 01
45500	3.002E 01	2.902E 01	2.884E 01	2.866E 01	2.898E 01	5.955E 01	4.230E 01	3.31			

100000	8.9708 01	8.9702 01	8.9696 01	8.9690 01	8.9684 01	8.9678 01	8.9672 01	8.9666 01	8.9660 01	8.9654 01	8.9648 01	8.9642 01	8.9636 01	8.9630 01	8.9624 01	8.9618 01	8.9612 01	8.9606 01	8.9600 01	8.9594 01	8.9588 01	8.9582 01	8.9576 01	8.9570 01	8.9564 01	8.9558 01	8.9552 01	8.9546 01	8.9540 01	8.9534 01	8.9528 01	8.9522 01	8.9516 01	8.9510 01	8.9504 01	8.9498 01	8.9492 01	8.9486 01	8.9480 01	8.9474 01	8.9468 01	8.9462 01	8.9456 01	8.9450 01	8.9444 01	8.9438 01	8.9432 01	8.9426 01	8.9420 01	8.9414 01	8.9408 01	8.9402 01	8.9396 01	8.9390 01	8.9384 01	8.9378 01	8.9372 01	8.9366 01	8.9360 01	8.9354 01	8.9348 01	8.9342 01	8.9336 01	8.9330 01	8.9324 01	8.9318 01	8.9312 01	8.9306 01	8.9300 01	8.9294 01	8.9288 01	8.9282 01	8.9276 01	8.9270 01	8.9264 01	8.9258 01	8.9252 01	8.9246 01	8.9240 01	8.9234 01	8.9228 01	8.9222 01	8.9216 01	8.9210 01	8.9204 01	8.9198 01	8.9192 01	8.9186 01	8.9180 01	8.9174 01	8.9168 01	8.9162 01	8.9156 01	8.9150 01	8.9144 01	8.9138 01	8.9132 01	8.9126 01	8.9120 01	8.9114 01	8.9108 01	8.9102 01	8.9096 01	8.9090 01	8.9084 01	8.9078 01	8.9072 01	8.9066 01	8.9060 01	8.9054 01	8.9048 01	8.9042 01	8.9036 01	8.9030 01	8.9024 01	8.9018 01	8.9012 01	8.9006 01	8.9000 01	8.8994 01	8.8988 01	8.8982 01	8.8976 01	8.8970 01	8.8964 01	8.8958 01	8.8952 01	8.8946 01	8.8940 01	8.8934 01	8.8928 01	8.8922 01	8.8916 01	8.8910 01	8.8904 01	8.8898 01	8.8892 01	8.8886 01	8.8880 01	8.8874 01	8.8868 01	8.8862 01	8.8856 01	8.8850 01	8.8844 01	8.8838 01	8.8832 01	8.8826 01	8.8820 01	8.8814 01	8.8808 01	8.8802 01	8.8796 01	8.8790 01	8.8784 01	8.8778 01	8.8772 01	8.8766 01	8.8760 01	8.8754 01	8.8748 01	8.8742 01	8.8736 01	8.8730 01	8.8724 01	8.8718 01	8.8712 01	8.8706 01	8.8700 01	8.8694 01	8.8688 01	8.8682 01	8.8676 01	8.8670 01	8.8664 01	8.8658 01	8.8652 01	8.8646 01	8.8640 01	8.8634 01	8.8628 01	8.8622 01	8.8616 01	8.8610 01	8.8604 01	8.8598 01	8.8592 01	8.8586 01	8.8580 01	8.8574 01	8.8568 01	8.8562 01	8.8556 01	8.8550 01	8.8544 01	8.8538 01	8.8532 01	8.8526 01	8.8520 01	8.8514 01	8.8508 01	8.8502 01	8.8496 01	8.8490 01	8.8484 01	8.8478 01	8.8472 01	8.8466 01	8.8460 01	8.8454 01	8.8448 01	8.8442 01	8.8436 01	8.8430 01	8.8424 01	8.8418 01	8.8412 01	8.8406 01	8.8400 01	8.8394 01	8.8388 01	8.8382 01	8.8376 01	8.8370 01	8.8364 01	8.8358 01	8.8352 01	8.8346 01	8.8340 01	8.8334 01	8.8328 01	8.8322 01	8.8316 01	8.8310 01	8.8304 01	8.8298 01	8.8292 01	8.8286 01	8.8280 01	8.8274 01	8.8268 01	8.8262 01	8.8256 01	8.8250 01	8.8244 01	8.8238 01	8.8232 01	8.8226 01	8.8220 01	8.8214 01	8.8208 01	8.8202 01	8.8196 01	8.8190 01	8.8184 01	8.8178 01	8.8172 01	8.8166 01	8.8160 01	8.8154 01	8.8148 01	8.8142 01	8.8136 01	8.8130 01	8.8124 01	8.8118 01	8.8112 01	8.8106 01	8.8100 01	8.8094 01	8.8088 01	8.8082 01	8.8076 01	8.8070 01	8.8064 01	8.8058 01	8.8052 01	8.8046 01	8.8040 01	8.8034 01	8.8028 01	8.8022 01	8.8016 01	8.8010 01	8.8004 01	8.7998 01	8.7992 01	8.7986 01	8.7980 01	8.7974 01	8.7968 01	
--------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	--



TABLE 105 (CONT.) DIMENSIONLESS INTERNAL ENERGY, E/RT, OF EQUILIBRIUM AIR

TEMP. (DEG K)	-3.5	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0
1000	1.911E 01	1.692E 01	1.561E 01	1.481E 01	1.426E 01	1.368E 01	1.273E 01	1.119E 01	9.333E 00	7.658E 00
1050	2.082E 01	1.783E 01	1.599E 01	1.488E 01	1.418E 01	1.362E 01	1.290E 01	1.168E 01	9.978E 00	8.345E 00
1100	2.290E 01	1.908E 01	1.681E 01	1.510E 01	1.418E 01	1.356E 01	1.294E 01	1.198E 01	1.051E 01	8.787E 00
1150	2.521E 01	2.061E 01	1.747E 01	1.550E 01	1.430E 01	1.353E 01	1.292E 01	1.215E 01	1.091E 01	9.289E 00
1200	2.752E 01	2.235E 01	1.856E 01	1.607E 01	1.452E 01	1.357E 01	1.290E 01	1.222E 01	1.119E 01	9.721E 00
1250	2.960E 01	2.419E 01	1.982E 01	1.679E 01	1.487E 01	1.368E 01	1.290E 01	1.224E 01	1.137E 01	1.007E 01
1300	3.128E 01	2.598E 01	2.120E 01	1.763E 01	1.532E 01	1.386E 01	1.294E 01	1.235E 01	1.148E 01	1.035E 01
1350	3.266E 01	2.760E 01	2.262E 01	1.864E 01	1.589E 01	1.413E 01	1.303E 01	1.227E 01	1.155E 01	1.055E 01
1400	3.314E 01	2.893E 01	2.401E 01	1.969E 01	1.653E 01	1.447E 01	1.317E 01	1.231E 01	1.159E 01	1.070E 01
1450	3.339E 01	2.992E 01	2.529E 01	2.078E 01	1.720E 01	1.489E 01	1.336E 01	1.238E 01	1.163E 01	1.062E 01
1500	3.331E 01	3.057E 01	2.638E 01	2.185E 01	1.808E 01	1.536E 01	1.360E 01	1.248E 01	1.168E 01	1.090E 01
1550	3.301E 01	3.090E 01	2.726E 01	2.285E 01	1.887E 01	1.589E 01	1.389E 01	1.261E 01	1.174E 01	1.097E 01
1600	3.257E 01	3.097E 01	2.791E 01	2.376E 01	1.968E 01	1.645E 01	1.423E 01	1.278E 01	1.181E 01	1.104E 01
1650	3.206E 01	3.085E 01	2.833E 01	2.454E 01	2.046E 01	1.704E 01	1.459E 01	1.297E 01	1.191E 01	1.110E 01
1700	3.151E 01	3.058E 01	2.855E 01	2.517E 01	2.119E 01	1.764E 01	1.499E 01	1.320E 01	1.202E 01	1.110E 01
1750	3.095E 01	3.023E 01	2.860E 01	2.565E 01	2.185E 01	1.823E 01	1.540E 01	1.345E 01	1.216E 01	1.126E 01
1800	3.040E 01	2.982E 01	2.852E 01	2.599E 01	2.244E 01	1.879E 01	1.583E 01	1.372E 01	1.231E 01	1.135E 01
1850	2.988E 01	2.939E 01	2.833E 01	2.615E 01	2.293E 01	1.931E 01	1.626E 01	1.401E 01	1.248E 01	1.145E 01
1900	2.940E 01	2.895E 01	2.808E 01	2.628E 01	2.332E 01	1.983E 01	1.668E 01	1.430E 01	1.267E 01	1.157E 01
1950	2.899E 01	2.852E 01	2.779E 01	2.626E 01	2.362E 01	2.027E 01	1.709E 01	1.460E 01	1.286E 01	1.171E 01
2000	2.865E 01	2.811E 01	2.746E 01	2.610E 01	2.383E 01	2.066E 01	1.749E 01	1.491E 01	1.307E 01	1.185E 01
2050	2.831E 01	2.788E 01	2.720E 01	2.599E 01	2.398E 01	2.105E 01	1.808E 01	1.604E 01	1.392E 01	1.250E 01
2100	2.806E 01	2.773E 01	2.703E 01	2.591E 01	2.415E 01	2.147E 01	1.944E 01	1.697E 01	1.474E 01	1.315E 01
2150	2.789E 01	2.766E 01	2.697E 01	2.587E 01	2.440E 01	2.185E 01	1.982E 01	1.757E 01	1.539E 01	1.372E 01
2200	2.779E 01	2.759E 01	2.692E 01	2.585E 01	2.463E 01	2.227E 01	2.027E 01	1.788E 01	1.584E 01	1.415E 01
2250	2.773E 01	2.759E 01	2.695E 01	2.585E 01	2.490E 01	2.266E 01	2.066E 01	1.801E 01	1.612E 01	1.445E 01
2300	2.773E 01	2.766E 01	2.702E 01	2.592E 01	2.513E 01	2.302E 01	2.105E 01	1.805E 01	1.620E 01	1.465E 01
2350	2.783E 01	2.783E 01	2.720E 01	2.606E 01	2.529E 01	2.311E 01	2.119E 01	1.816E 01	1.630E 01	1.487E 01
2400	2.799E 01	2.806E 01	2.745E 01	2.628E 01	2.556E 01	2.340E 01	2.147E 01	1.849E 01	1.660E 01	1.497E 01
2450	2.821E 01	2.834E 01	2.775E 01	2.658E 01	2.588E 01	2.370E 01	2.176E 01	1.895E 01	1.680E 01	1.508E 01
2500	2.848E 01	2.866E 01	2.808E 01	2.692E 01	2.625E 01	2.405E 01	2.210E 01	1.942E 01	1.708E 01	1.523E 01
2550	2.880E 01	2.902E 01	2.845E 01	2.730E 01	2.668E 01	2.448E 01	2.248E 01	1.985E 01	1.743E 01	1.543E 01
2600	2.917E 01	2.943E 01	2.888E 01	2.768E 01	2.712E 01	2.492E 01	2.282E 01	2.005E 01	1.785E 01	1.567E 01
2650	2.959E 01	2.989E 01	2.935E 01	2.812E 01	2.760E 01	2.540E 01	2.330E 01	2.072E 01	1.831E 01	1.595E 01
2700	3.006E 01	3.040E 01	2.986E 01	2.865E 01	2.818E 01	2.598E 01	2.388E 01	2.139E 01	1.880E 01	1.626E 01
2750	3.058E 01	3.094E 01	3.040E 01	2.920E 01	2.878E 01	2.658E 01	2.448E 01	2.200E 01	1.940E 01	1.656E 01
2800	3.115E 01	3.154E 01	3.100E 01	2.980E 01	2.942E 01	2.722E 01	2.512E 01	2.264E 01	2.004E 01	1.686E 01
2850	3.177E 01	3.218E 01	3.164E 01	3.044E 01	3.010E 01	2.792E 01	2.582E 01	2.334E 01	2.074E 01	1.716E 01
2900	3.244E 01	3.287E 01	3.233E 01	3.114E 01	3.084E 01	2.864E 01	2.654E 01	2.406E 01	2.146E 01	1.746E 01
2950	3.316E 01	3.361E 01	3.307E 01	3.188E 01	3.162E 01	2.942E 01	2.732E 01	2.484E 01	2.224E 01	1.776E 01
3000	3.393E 01	3.439E 01	3.385E 01	3.266E 01	3.244E 01	3.024E 01	2.814E 01	2.566E 01	2.306E 01	1.806E 01
3050	3.475E 01	3.522E 01	3.468E 01	3.349E 01	3.332E 01	3.112E 01	2.902E 01	2.654E 01	2.394E 01	1.836E 01
3100	3.562E 01	3.610E 01	3.556E 01	3.437E 01	3.424E 01	3.204E 01	2.994E 01	2.746E 01	2.486E 01	1.866E 01
3150	3.654E 01	3.703E 01	3.649E 01	3.530E 01	3.522E 01	3.302E 01	3.092E 01	2.844E 01	2.584E 01	1.896E 01
3200	3.751E 01	3.801E 01	3.747E 01	3.628E 01	3.624E 01	3.404E 01	3.194E 01	2.946E 01	2.686E 01	1.926E 01
3250	3.853E 01	3.904E 01	3.850E 01	3.731E 01	3.732E 01	3.512E 01	3.302E 01	3.054E 01	2.794E 01	1.956E 01
3300	3.960E 01	4.012E 01	3.958E 01	3.839E 01	3.844E 01	3.624E 01	3.414E 01	3.166E 01	2.906E 01	2.109E 01
3350	4.072E 01	4.125E 01	4.070E 01	3.951E 01	3.960E 01	3.740E 01	3.530E 01	3.282E 01	3.022E 01	2.239E 01
3400	4.189E 01	4.243E 01	4.187E 01	4.068E 01	4.080E 01	3.860E 01	3.650E 01	3.402E 01	3.142E 01	2.369E 01
3450	4.311E 01	4.366E 01	4.314E 01	4.195E 01	4.210E 01	3.990E 01	3.780E 01	3.532E 01	3.272E 01	2.499E 01
3500	4.438E 01	4.494E 01	4.446E 01	4.327E 01	4.346E 01	4.126E 01	3.916E 01	3.668E 01	3.408E 01	2.629E 01
3550	4.570E 01	4.627E 01	4.578E 01	4.459E 01	4.482E 01	4.262E 01	4.052E 01	3.804E 01	3.544E 01	2.759E 01
3600	4.707E 01	4.765E 01	4.724E 01	4.605E 01	4.632E 01	4.412E 01	4.202E 01	3.954E 01	3.694E 01	2.889E 01
3650	4.849E 01	4.908E 01	4.868E 01	4.749E 01	4.780E 01	4.560E 01	4.350E 01	4.102E 01	3.842E 01	3.019E 01
3700	4.996E 01	5.056E 01	5.016E 01	4.897E 01	4.932E 01	4.712E 01	4.502E 01	4.254E 01	4.004E 01	3.149E 01
3750	5.148E 01	5.209E 01	5.169E 01	5.050E 01	5.090E 01	4.870E 01	4.660E 01	4.412E 01	4.162E 01	3.279E 01
3800	5.305E 01	5.367E 01	5.327E 01	5.208E 01	5.252E 01	5.032E 01	4.822E 01	4.574E 01	4.324E 01	3.409E 01
3850	5.467E 01	5.530E 01	5.490E 01	5.371E 01	5.418E 01	5.198E 01	4.988E 01	4.740E 01	4.490E 01	3.539E 01
3900	5.634E 01	5.698E 01	5.658E 01	5.539E 01	5.590E 01	5.370E 01	5.160E 01	4.912E 01	4.662E 01	3.669E 01
3950	5.806E 01	5.871E 01	5.831E 01	5.712E 01	5.768E 01	5.548E 01	5.338E 01	5.090E 01	4.840E 01	3.799E 01
4000	5.983E 01	6.049E 01	6.009E 01	5.890E 01	5.950E 01	5.730E 01	5.520E 01	5.272E 01	5.022E 01	3.929E 01

15CCCO	7.779E 01	7.779E 01	9.971E 01	9.754E 01	9.083E 01	4.416E 01	3.801E 01	3.204E 01	2.062E 01	2.394E 01
20CCCO	6.552E 01	6.481E 01	6.328E 01	6.071E 01	5.701E 01	5.192E 01	4.584E 01	3.972E 01	3.407E 01	2.912E 01
30CCCO	5.403E 01	5.391E 01	5.367E 01	5.314E 01	5.20CE 01	4.986E 01	4.649E 01	4.26CE 01	3.844E 01	3.172E 01
40CCCO	4.275E 01	4.241E 01	4.220E 01	4.199E 01	4.169E 01	4.115E 01	4.015E 01	3.839E 01	3.562E 01	3.113E 01
50CCCO	5.763E 01	4.988E 01	4.288E 01	3.882E 01	3.699E 01	3.607E 01	3.529E 01	3.429E 01	3.261E 01	3.016E 01
60CCCO	7.545E 01	6.541E 01	5.774E 01	5.130E 01	4.447E 01	3.833E 01	3.447E 01	3.279E 01	3.060E 01	2.862E 01
70CCCO	8.853E 01	7.675E 01	7.091E 01	6.254E 01	5.424E 01	4.742E 01	4.099E 01	3.521E 01	3.112E 01	2.827E 01
80CCCO	7.149E 01	7.114E 01	7.023E 01	6.83CE 01	6.513E 01	6.048E 01	5.388E 01	4.69CE 01	3.978E 01	3.374E 01
90CCCO	6.224E 01	6.221E 01	6.212E 01	6.189E 01	6.131E 01	5.992E 01	5.726E 01	5.304E 01	4.719E 01	4.052E 01
10CCCO	4.972E 01	4.971E 01	4.969E 01	4.966E 01	4.960E 01	4.947E 01	4.922E 01	4.866E 01	4.748E 01	4.517E 01
20CCCO	4.346E 01	4.345E 01	4.344E 01	4.342E 01	4.318E 01	4.332E 01	4.320E 01	4.297E 01	4.294E 01	4.17CE 01
30CCCO	3.749E 01	3.743E 01	3.736E 01	3.728E 01	3.721E 01	3.714E 01	3.706E 01	3.695E 01	3.675E 01	3.639E 01
40CCCO	3.431E 01	3.431E 01	3.430E 01	3.429E 01	3.428E 01	3.420E 01	3.411E 01	3.398E 01	3.381E 01	3.357E 01
50CCCO	3.239E 01	3.238E 01	3.238E 01	3.238E 01	3.237E 01	3.235E 01	3.231E 01	3.224E 01	3.211E 01	3.191E 01
60CCCO	3.110E 01	3.110E 01	3.110E 01	3.109E 01	3.109E 01	3.107E 01	3.105E 01	3.101E 01	3.093E 01	3.079E 01
70CCCO	2.949E 01	2.949E 01	2.949E 01	2.949E 01	2.949E 01	2.948E 01	2.946E 01	2.944E 01	2.940E 01	2.932E 01
80CCCO	2.853E 01	2.853E 01	2.853E 01	2.853E 01	2.852E 01	2.852E 01	2.851E 01	2.849E 01	2.846E 01	2.841E 01

TABLE 106. INTERNAL ENERGY (ERG/GM) OF EQUILIBRIUM AIR

TEMP. (DEG K)	-9.0	-8.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.5	-5.0	-4.5	-4.0
10000	1.422E 12	1.421E 12	1.421E 12	1.418E 12	1.439E 12	1.383E 12	1.315E 12	1.18CE 12	9.885F 11	7.981E 11	6.493E 11
10500	1.432E 12	1.432E 12	1.431E 12	1.430E 12	1.426E 12	1.414E 12	1.380E 12	1.297E 12	1.143E 12	9.441E 11	7.638E 11
11000	1.445E 12	1.442E 12	1.442E 12	1.441E 12	1.439E 12	1.433E 12	1.416E 12	1.370E 12	1.264E 12	1.090E 12	8.924E 11
11500	1.464E 12	1.455E 12	1.453E 12	1.451E 12	1.450E 12	1.447E 12	1.439E 12	1.413E 12	1.340E 12	1.214E 12	1.024E 12
12000	1.504E 12	1.476E 12	1.466E 12	1.463E 12	1.461E 12	1.459E 12	1.455E 12	1.441E 12	1.402E 12	1.309E 12	1.146E 12
12500	1.502E 12	1.518E 12	1.487E 12	1.476E 12	1.473E 12	1.471E 12	1.468E 12	1.460E 12	1.437E 12	1.376E 12	1.249E 12
13000	1.798E 12	1.608E 12	1.526E 12	1.496E 12	1.486E 12	1.482E 12	1.480E 12	1.475E 12	1.461E 12	1.422E 12	1.329E 12
13500	2.104E 12	1.782E 12	1.604E 12	1.531E 12	1.504E 12	1.495E 12	1.491E 12	1.488E 12	1.479E 12	1.454E 12	1.389E 12
14000	2.464E 12	2.053E 12	1.753E 12	1.598E 12	1.535E 12	1.512E 12	1.504E 12	1.500E 12	1.494E 12	1.477E 12	1.433E 12
14500	2.793E 12	2.382E 12	1.985E 12	1.718E 12	1.588E 12	1.537E 12	1.519E 12	1.512E 12	1.507E 12	1.496E 12	1.465E 12
15000	3.058E 12	2.705E 12	2.279E 12	1.908E 12	1.681E 12	1.579E 12	1.540E 12	1.527E 12	1.520E 12	1.511E 12	1.490E 12
15500	3.272E 12	2.979E 12	2.508E 12	2.161E 12	1.850E 12	1.649E 12	1.572E 12	1.544E 12	1.533E 12	1.525E 12	1.510E 12
16000	3.445E 12	3.203E 12	2.869E 12	2.446E 12	2.037E 12	1.759E 12	1.623E 12	1.569E 12	1.549E 12	1.539E 12	1.526E 12
16500	3.570E 12	3.387E 12	3.105E 12	2.725E 12	2.287E 12	1.919E 12	1.702E 12	1.605E 12	1.568E 12	1.553E 12	1.542E 12
17000	3.652E 12	3.528E 12	3.303E 12	2.974E 12	2.552E 12	2.124E 12	1.817E 12	1.659E 12	1.594E 12	1.570E 12	1.556E 12
17500	3.704E 12	3.627E 12	3.422E 12	3.187E 12	2.806E 12	2.359E 12	1.974E 12	1.739E 12	1.631E 12	1.590E 12	1.572E 12
18000	3.740E 12	3.693E 12	3.502E 12	3.365E 12	3.033E 12	2.604E 12	2.167E 12	1.850E 12	1.684E 12	1.616E 12	1.588E 12
18500	3.770E 12	3.738E 12	3.607E 12	3.508E 12	3.230E 12	2.838E 12	2.383E 12	1.995E 12	1.759E 12	1.651E 12	1.608E 12
19000	3.799E 12	3.772E 12	3.725E 12	3.616E 12	3.396E 12	3.051E 12	2.608E 12	2.169E 12	1.858E 12	1.699E 12	1.632E 12
19500	3.835E 12	3.802E 12	3.748E 12	3.694E 12	3.530E 12	3.237E 12	2.828E 12	2.364E 12	1.985E 12	1.763E 12	1.644E 12
20000	3.866E 12	3.835E 12	3.802E 12	3.750E 12	3.633E 12	3.397E 12	3.028E 12	2.588E 12	2.137E 12	1.848E 12	1.705E 12
20500	3.896E 12	3.866E 12	3.835E 12	3.788E 12	3.851E 12	3.776E 12	3.611E 12	3.303E 12	2.862E 12	2.384E 12	2.013E 12
21000	3.927E 12	3.897E 12	3.871E 12	3.838E 12	4.021E 12	3.943E 12	3.873E 12	3.740E 12	3.472E 12	3.050E 12	2.557E 12
21500	3.957E 12	3.927E 12	3.900E 12	3.871E 12	4.058E 12	4.178E 12	4.040E 12	3.944E 12	3.826E 12	3.570E 12	3.151E 12
22000	3.986E 12	3.956E 12	3.928E 12	3.900E 12	4.095E 12	4.286E 12	4.347E 12	4.141E 12	4.027E 12	3.886E 12	3.617E 12
22500	4.015E 12	3.985E 12	3.957E 12	3.929E 12	4.132E 12	4.386E 12	4.502E 12	4.497E 12	4.234E 12	4.089E 12	3.920E 12
23000	4.044E 12	4.014E 12	3.986E 12	3.958E 12	4.169E 12	4.425E 12	4.599E 12	4.579E 12	4.604E 12	4.307E 12	4.133E 12
23500	4.073E 12	4.043E 12	4.015E 12	3.987E 12	4.206E 12	4.468E 12	4.683E 12	4.677E 12	5.249E 12	4.666E 12	4.354E 12
24000	4.102E 12	4.072E 12	4.044E 12	4.016E 12	4.243E 12	4.507E 12	4.750E 12	4.744E 12	5.069E 12	5.242E 12	4.680E 12
24500	4.131E 12	4.101E 12	4.073E 12	4.045E 12	4.280E 12	4.546E 12	4.831E 12	4.825E 12	6.854E 12	5.919E 12	5.176E 12
25000	4.160E 12	4.130E 12	4.102E 12	4.074E 12	4.317E 12	4.585E 12	4.915E 12	4.909E 12	7.474E 12	6.721E 12	5.820E 12
25500	4.189E 12	4.159E 12	4.131E 12	4.103E 12	4.354E 12	4.624E 12	5.045E 12	5.039E 12	7.929E 12	7.352E 12	6.509E 12
26000	4.218E 12	4.188E 12	4.160E 12	4.132E 12	4.391E 12	4.663E 12	5.185E 12	5.179E 12	8.308E 12	7.845E 12	7.143E 12
26500	4.247E 12	4.217E 12	4.189E 12	4.161E 12	4.428E 12	4.702E 12	5.325E 12	5.319E 12	8.736E 12	8.246E 12	7.673E 12
27000	4.276E 12	4.246E 12	4.218E 12	4.190E 12	4.465E 12	4.741E 12	5.465E 12	5.459E 12	9.322E 12	8.646E 12	8.110E 12
27500	4.305E 12	4.275E 12	4.247E 12	4.219E 12	4.502E 12	4.780E 12	5.608E 12	5.602E 12	1.010E 13	9.134E 12	8.506E 12
28000	4.334E 12	4.304E 12	4.276E 12	4.248E 12	4.539E 12	4.819E 12	5.751E 12	5.745E 12	1.415E 13	1.298E 13	1.155E 13
28500	4.363E 12	4.333E 12	4.305E 12	4.277E 12	4.576E 12	4.858E 12	5.902E 12	5.896E 12	1.803E 13	1.628E 13	1.489E 13
29000	4.392E 12	4.362E 12	4.334E 12	4.306E 12	4.615E 12	4.897E 12	6.053E 12	6.047E 12	2.157E 13	2.019E 13	1.831E 13

100000	2.575E 13	2.575E 13	2.574E 13	2.574E 13	2.573E 13	2.570E 13	2.562E 13	2.548E 13	2.527E 13	2.502E 13	2.472E 13	2.438E 13
150000	2.842E 13	2.842E 13	2.841E 13	2.841E 13	2.841E 13	2.841E 13	2.841E 13	2.840E 13	2.840E 13	2.840E 13	2.838E 13	2.834E 13
200000	3.244E 13	3.244E 13	3.243E 13	3.243E 13	3.243E 13	3.243E 13	3.243E 13	3.242E 13	3.242E 13	3.242E 13	3.240E 13	3.236E 13
300000	1.069E 14	9.703E 13	8.486E 13	7.506E 13	6.941E 13	6.532E 13	5.961E 13	5.134E 13	4.369E 13	3.932E 13	3.106E 13	2.105E 13
400000	1.354E 14	1.340E 14	1.311E 14	1.272E 14	1.230E 14	1.206E 14	1.192E 14	1.092E 14	9.192E 13	8.082E 13	7.334E 13	
500000	1.634E 14	1.434E 14	1.433E 14	1.432E 14	1.430E 14	1.422E 14	1.402E 14	1.366E 14	1.321E 14	1.274E 14	1.263E 14	
600000	1.504E 14	1.504E 14	1.504E 14	1.504E 14	1.504E 14	1.504E 14	1.503E 14	1.501E 14	1.494E 14	1.476E 14	1.439E 14	
800000	1.646E 14	1.646E 14	1.646E 14	1.646E 14	1.646E 14	1.646E 14	1.646E 14	1.646E 14	1.646E 14	1.646E 14	1.646E 14	
1000000	1.787E 14	1.787E 14	1.787E 14	1.787E 14	1.787E 14	1.787E 14	1.787E 14	1.787E 14	1.787E 14	1.787E 14	1.787E 14	
1500000	2.147E 14	2.144E 14	2.142E 14	2.141E 14	2.141E 14	2.141E 14	2.141E 14	2.141E 14	2.141E 14	2.141E 14	2.141E 14	
2000000	2.523E 14	2.523E 14	2.522E 14	2.520E 14	2.514E 14	2.511E 14	2.507E 14	2.502E 14	2.498E 14	2.496E 14	2.495E 14	
3000000	3.231E 14	3.231E 14	3.231E 14	3.231E 14	3.231E 14	3.231E 14	3.231E 14	3.231E 14	3.231E 14	3.231E 14	3.231E 14	
4000000	3.940E 14	3.940E 14	3.940E 14	3.940E 14	3.940E 14	3.940E 14	3.940E 14	3.940E 14	3.940E 14	3.940E 14	3.940E 14	
5000000	4.648E 14	4.648E 14	4.648E 14	4.648E 14	4.648E 14	4.648E 14	4.648E 14	4.648E 14	4.648E 14	4.648E 14	4.648E 14	
6000000	5.356E 14	5.356E 14	5.356E 14	5.356E 14	5.356E 14	5.356E 14	5.356E 14	5.356E 14	5.356E 14	5.356E 14	5.356E 14	
8000000	6.773E 14	6.773E 14	6.773E 14	6.773E 14	6.773E 14	6.773E 14	6.773E 14	6.773E 14	6.773E 14	6.773E 14	6.773E 14	
10000000	8.189E 14	8.189E 14	8.189E 14	8.189E 14	8.189E 14	8.189E 14	8.189E 14	8.189E 14	8.189E 14	8.189E 14	8.189E 14	

TABLE 1C6(Cont): INTERNAL ENERGY (ERG/CM) OF EQUILIBRIUM AIR

TEMP. (°C K)	-3.5	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0
10000	3.404E 11	4.857E 11	4.479E 11	4.250E 11	4.092E 11	3.925E 11	3.653E 11	3.212E 11	2.679E 11	2.140E 11
10500	6.273E 11	5.374E 11	4.810E 11	4.483E 11	4.273E 11	4.105E 11	3.807E 11	3.525E 11	3.007E 11	2.481E 11
11000	7.231E 11	6.023E 11	5.245E 11	4.769E 11	4.479E 11	4.281E 11	4.009E 11	3.784E 11	3.318E 11	2.773E 11
11500	8.320E 11	6.803E 11	5.748E 11	5.116E 11	4.719E 11	4.467E 11	4.264E 11	4.009E 11	3.461E 11	3.044E 11
12000	9.477E 11	7.700E 11	6.392E 11	5.534E 11	5.002E 11	4.673E 11	4.444E 11	4.208E 11	3.654E 11	3.240E 11
12500	1.042E 12	8.679E 11	7.111E 11	6.025E 11	5.334E 11	4.907E 11	4.623E 11	4.393E 11	4.000E 11	3.614E 11
13000	1.147E 12	9.695E 11	7.916E 11	6.590E 11	5.710E 11	5.173E 11	4.829E 11	4.572E 11	4.204E 11	3.841E 11
13500	1.250E 12	1.069E 12	8.766E 11	7.223E 11	6.157E 11	5.476E 11	5.049E 11	4.759E 11	4.475E 11	4.089E 11
14000	1.332E 12	1.163E 12	9.649E 11	7.914E 11	6.649E 11	5.817E 11	5.292E 11	4.947E 11	4.659E 11	4.302E 11
14500	1.389E 12	1.245E 12	1.052E 12	8.648E 11	7.190E 11	6.197E 11	5.561E 11	5.152E 11	4.842E 11	4.501E 11
15000	1.434E 12	1.316E 12	1.136E 12	9.406E 11	7.775E 11	6.615E 11	5.857E 11	5.372E 11	5.029E 11	4.693E 11
15500	1.469E 12	1.375E 12	1.213E 12	1.017E 12	8.394E 11	7.049E 11	6.182E 11	5.611E 11	5.222E 11	4.881E 11
16000	1.496E 12	1.422E 12	1.282E 12	1.091E 12	9.036E 11	7.556E 11	6.533E 11	5.868E 11	5.425E 11	5.040E 11
16500	1.518E 12	1.461E 12	1.342E 12	1.162E 12	9.680E 11	8.070E 11	6.911E 11	6.195E 11	5.640E 11	5.259E 11
17000	1.537E 12	1.492E 12	1.393E 12	1.228E 12	1.034E 12	8.605E 11	7.313E 11	6.451E 11	5.847E 11	5.453E 11
17500	1.554E 12	1.518E 12	1.437E 12	1.289E 12	1.090E 12	9.154E 11	7.735E 11	6.756E 11	6.100E 11	5.654E 11
18000	1.570E 12	1.541E 12	1.473E 12	1.343E 12	1.159E 12	9.710E 11	8.177E 11	7.086E 11	6.361E 11	5.843E 11
18500	1.587E 12	1.561E 12	1.505E 12	1.391E 12	1.217E 12	1.027E 12	8.632E 11	7.437E 11	6.628E 11	6.080E 11
19000	1.603E 12	1.579E 12	1.532E 12	1.433E 12	1.272E 12	1.081E 12	9.097E 11	7.800E 11	6.908E 11	6.311E 11
19500	1.622E 12	1.596E 12	1.555E 12	1.470E 12	1.322E 12	1.134E 12	9.567E 11	8.174E 11	7.199E 11	6.553E 11
20000	1.645E 12	1.614E 12	1.577E 12	1.503E 12	1.368E 12	1.186E 12	1.004E 12	8.588E 11	7.501E 11	6.804E 11
20500	1.661E 12	1.704E 12	1.654E 12	1.604E 12	1.514E 12	1.267E 12	1.186E 12	1.014E 12	8.788E 11	7.891E 11
21000	2.139E 12	1.882E 12	1.757E 12	1.688E 12	1.610E 12	1.506E 12	1.344E 12	1.169E 12	1.015E 12	9.059E 11
26000	2.649E 12	2.213E 12	1.938E 12	1.796E 12	1.710E 12	1.615E 12	1.479E 12	1.311E 12	1.148E 12	1.024E 12
28000	3.183E 12	2.671E 12	2.239E 12	1.967E 12	1.819E 12	1.714E 12	1.592E 12	1.437E 12	1.273E 12	1.137E 12
30000	3.618E 12	3.153E 12	2.638E 12	2.228E 12	1.972E 12	1.822E 12	1.696E 12	1.551E 12	1.388E 12	1.245E 12
32000	3.924E 12	3.569E 12	3.070E 12	2.565E 12	2.189E 12	1.958E 12	1.804E 12	1.658E 12	1.495E 12	1.340E 12
34000	4.150E 12	3.687E 12	3.468E 12	2.843E 12	2.469E 12	2.138E 12	1.929E 12	1.764E 12	1.558E 12	1.462E 12
36000	4.370E 12	4.132E 12	3.750E 12	3.314E 12	2.789E 12	2.364E 12	2.080E 12	1.894E 12	1.702E 12	1.537E 12
38000	4.659E 12	4.354E 12	4.044E 12	3.648E 12	3.122E 12	2.627E 12	2.263E 12	2.017E 12	1.811E 12	1.632E 12
40000	5.071E 12	4.610E 12	4.296E 12	3.933E 12	3.442E 12	2.912E 12	2.475E 12	2.169E 12	1.929E 12	1.732E 12
42000	5.612E 12	4.946E 12	4.532E 12	4.181E 12	3.734E 12	3.201E 12	2.710E 12	2.341E 12	2.059E 12	1.837E 12
44000	6.228E 12	5.303E 12	4.810E 12	4.414E 12	3.998E 12	3.481E 12	2.958E 12	2.522E 12	2.201E 12	1.944E 12
46000	6.841E 12	5.704E 12	5.155E 12	4.658E 12	4.236E 12	3.744E 12	3.208E 12	2.735E 12	2.357E 12	2.069E 12
48000	7.394E 12	6.463E 12	5.744E 12	4.937E 12	4.470E 12	3.990E 12	3.454E 12	2.947E 12	2.523E 12	2.198E 12
50000	7.874E 12	7.012E 12	6.049E 12	5.265E 12	4.713E 12	4.223E 12	3.692E 12	3.162E 12	2.698E 12	2.334E 12
60000	1.019E 13	9.193E 12	8.354E 12	7.392E 12	6.365E 12	5.497E 12	4.816E 12	4.210E 12	3.623E 12	3.095E 12
70000	1.353E 13	1.199E 13	1.052E 13	9.355E 12	8.295E 12	7.188E 12	6.158E 12	5.307E 12	4.583E 12	3.931E 12
80000	1.647E 13	1.490E 13	1.330E 13	1.163E 13	1.016E 13	8.904E 12	7.700E 12	6.550E 12	5.649E 12	4.842E 12

190000	2.821E 13	2.790E 13	2.725E 13	2.614E 13	2.432E 13	2.222E 13	2.000E 13	1.777E 13	1.555E 13	1.333E 13	1.111E 13	9.89E 12	8.67E 12	7.45E 12	6.23E 12	5.01E 12	3.79E 12	2.57E 12	1.35E 12	1.13E 12
200000	3.101E 13	3.095E 13	3.081E 13	3.051E 13	2.985E 13	2.862E 13	2.740E 13	2.618E 13	2.496E 13	2.374E 13	2.252E 13	2.130E 13	2.008E 13	1.886E 13	1.764E 13	1.642E 13	1.520E 13	1.398E 13	1.276E 13	1.154E 13
300000	3.601E 13	3.652E 13	3.634E 13	3.616E 13	3.590E 13	3.543E 13	3.496E 13	3.449E 13	3.402E 13	3.355E 13	3.308E 13	3.261E 13	3.214E 13	3.167E 13	3.120E 13	3.073E 13	3.026E 13	2.979E 13	2.932E 13	2.885E 13
400000	6.616E 13	5.727E 13	4.923E 13	4.457E 13	4.247E 13	4.141E 13	4.032E 13	3.932E 13	3.832E 13	3.744E 13	3.656E 13	3.568E 13	3.480E 13	3.392E 13	3.304E 13	3.216E 13	3.128E 13	3.040E 13	2.952E 13	2.864E 13

500000	1.083E 14	9.419E 13	8.287E 13	7.343E 13	6.383E 13	5.501E 13	4.947E 13	4.635E 13	4.392E 13	4.158E 13	3.924E 13	3.690E 13	3.456E 13	3.222E 13	2.988E 13	2.754E 13	2.520E 13	2.286E 13	2.052E 13	1.818E 13
600000	1.387E 14	1.322E 14	1.221E 14	1.077E 14	9.340E 13	8.167E 13	7.060E 13	6.044E 13	5.360E 13	4.806E 13	4.352E 13	3.908E 13	3.464E 13	3.020E 13	2.576E 13	2.132E 13	1.688E 13	1.244E 13	800E 12	356E 12
800000	1.642E 14	1.634E 14	1.613E 14	1.568E 14	1.496E 14	1.389E 14	1.237E 14	1.080E 14	9.134E 13	7.740E 13	6.642E 13	5.744E 13	4.946E 13	4.248E 13	3.550E 13	2.852E 13	2.154E 13	1.456E 13	758E 12	454E 12
1000000	1.787E 14	1.786E 14	1.783E 14	1.777E 14	1.760E 14	1.720E 14	1.643E 14	1.522E 14	1.354E 14	1.136E 14	9.18E 13	7.40E 13	5.92E 13	4.62E 13	3.42E 13	2.32E 13	1.32E 13	424E 12	128E 12	28E 12
1500000	2.141E 14	2.140E 14	2.139E 14	2.138E 14	2.135E 14	2.130E 14	2.119E 14	2.095E 14	2.044E 14	1.945E 14	1.806E 14	1.642E 14	1.456E 14	1.248E 14	1.020E 14	782E 13	544E 13	306E 13	62E 13	2E 13
2000000	2.495E 14	2.494E 14	2.494E 14	2.492E 14	2.490E 14	2.487E 14	2.480E 14	2.467E 14	2.442E 14	2.394E 14	2.306E 14	2.182E 14	2.022E 14	1.826E 14	1.594E 14	1.326E 14	958E 13	590E 13	154E 13	54E 13
3000000	3.228E 14	3.223E 14	3.217E 14	3.210E 14	3.204E 14	3.198E 14	3.191E 14	3.181E 14	3.164E 14	3.134E 14	3.082E 14	3.002E 14	2.886E 14	2.734E 14	2.546E 14	2.322E 14	2.062E 14	1.766E 14	1.434E 14	1.06E 14
4000000	3.939E 14	3.934E 14	3.930E 14	3.927E 14	3.923E 14	3.927E 14	3.918E 14	3.902E 14	3.882E 14	3.848E 14	3.792E 14	3.708E 14	3.592E 14	3.440E 14	3.252E 14	3.028E 14	2.768E 14	2.472E 14	2.140E 14	1.774E 14
5000000	4.648E 14	4.648E 14	4.647E 14	4.646E 14	4.645E 14	4.642E 14	4.637E 14	4.627E 14	4.609E 14	4.579E 14	4.534E 14	4.470E 14	4.386E 14	4.272E 14	4.128E 14	3.954E 14	3.750E 14	3.516E 14	3.254E 14	2.964E 14
6000000	5.356E 14	5.356E 14	5.355E 14	5.355E 14	5.354E 14	5.352E 14	5.348E 14	5.341E 14	5.327E 14	5.303E 14	5.268E 14	5.212E 14	5.136E 14	5.040E 14	4.914E 14	4.758E 14	4.572E 14	4.356E 14	4.110E 14	3.834E 14
8000000	6.773E 14	6.772E 14	6.772E 14	6.772E 14	6.771E 14	6.769E 14	6.765E 14	6.760E 14	6.750E 14	6.732E 14	6.706E 14	6.662E 14	6.606E 14	6.528E 14	6.428E 14	6.304E 14	6.156E 14	5.984E 14	5.788E 14	5.568E 14
10000000	8.189E 14	8.189E 14	8.189E 14	8.189E 14	8.187E 14	8.186E 14	8.184E 14	8.180E 14	8.169E 14	8.153E 14	8.128E 14	8.084E 14	8.028E 14	7.950E 14	7.850E 14	7.726E 14	7.578E 14	7.406E 14	7.210E 14	6.990E 14

TABLE 107. INTERNAL ENERGY DENSITY (ERG/CM<sup>3</sup>) OF EQUILIBRIUM AIR

TEMP. (DEG K)	-9.0	-8.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.5	-5.0	-4.5	-4.0
1000	1.837E 00	5.809E 00	1.836E 01	5.793E 01	1.821E 02	5.651E 02	1.700E 03	4.820E 03	1.277E 04	3.262E 04	8.391E 04
1050	1.851E 00	5.851E 00	1.849E 01	5.843E 01	1.843E 02	5.779E 02	1.784E 03	5.300E 03	1.477E 04	3.866E 04	9.871E 04
1100	1.867E 00	5.895E 00	1.863E 01	5.888E 01	1.859E 02	5.857E 02	1.830E 03	5.598E 03	1.634E 04	4.456E 04	1.153E 05
1150	1.892E 00	5.948E 00	1.877E 01	5.931E 01	1.874E 02	5.915E 02	1.859E 03	5.776E 03	1.742E 04	4.961E 04	1.323E 05
1200	1.946E 00	6.032E 00	1.895E 01	5.977E 01	1.883E 02	5.964E 02	1.880E 03	5.887E 03	1.811E 04	5.368E 04	1.481E 05
1250	2.071E 00	6.203E 00	1.921E 01	6.033E 01	1.903E 02	6.010E 02	1.897E 03	5.965E 03	1.856E 04	5.622E 04	1.614E 05
1300	2.323E 00	6.571E 00	1.972E 01	6.114E 01	1.920E 02	6.057E 02	1.912E 03	6.026E 03	1.882E 04	5.810E 04	1.718E 05
1350	2.720E 00	7.282E 00	2.075E 01	6.258E 01	1.944E 02	6.110E 02	1.927E 03	6.079E 03	1.911E 04	5.941E 04	1.795E 05
1400	3.184E 00	8.389E 00	2.266E 01	6.530E 01	1.983E 02	6.179E 02	1.944E 03	6.129E 03	1.930E 04	6.037E 04	1.852E 05
1450	3.610E 00	9.736E 00	2.365E 01	7.021E 01	2.032E 02	6.283E 02	1.963E 03	6.181E 03	1.947E 04	6.112E 04	1.893E 05
1500	4.052E 00	1.105E 01	2.445E 01	7.796E 01	2.173E 02	6.453E 02	1.991E 03	6.238E 03	1.964E 04	6.176E 04	1.925E 05
1550	4.229E 00	1.217E 01	3.345E 01	8.829E 01	2.365E 02	6.738E 02	2.032E 03	6.311E 03	1.982E 04	6.233E 04	1.951E 05
1600	4.452E 00	1.309E 01	3.707E 01	9.995E 01	2.632E 02	7.190E 02	2.097E 03	6.411E 03	2.002E 04	6.289E 04	1.973E 05
1650	4.614E 00	1.384E 01	4.013E 01	1.114E 02	2.935E 02	7.642E 02	2.199E 03	6.558E 03	2.027E 04	6.348E 04	1.992E 05
1700	4.719E 00	1.442E 01	4.268E 01	1.216E 02	3.298E 02	8.680E 02	2.349E 03	6.780E 03	2.060E 04	6.415E 04	2.011E 05
1750	4.787E 00	1.482E 01	4.474E 01	1.302E 02	3.626E 02	9.642E 02	2.551E 03	7.106E 03	2.108E 04	6.497E 04	2.031E 05
1800	4.833E 00	1.509E 01	4.629E 01	1.375E 02	3.920E 02	1.064E 03	2.800E 03	7.561E 03	2.177E 04	6.603E 04	2.053E 05
1850	4.871E 00	1.528E 01	4.739E 01	1.434E 02	4.174E 02	1.160E 03	3.080E 03	8.151E 03	2.273E 04	6.746E 04	2.078E 05
1900	4.910E 00	1.541E 01	4.814E 01	1.478E 02	4.388E 02	1.247E 03	3.370E 03	8.863E 03	2.402E 04	6.942E 04	2.110E 05
1950	4.956E 00	1.554E 01	4.865E 01	1.510E 02	4.562E 02	1.323E 03	3.652E 03	9.659E 03	2.565E 04	7.206E 04	2.150E 05
2000	5.022E 00	1.567E 01	4.913E 01	1.533E 02	4.695E 02	1.388E 03	3.913E 03	1.050E 04	2.762E 04	7.551E 04	2.203E 05
2200	5.875E 00	1.695E 01	5.131E 01	1.593E 02	4.977E 02	1.543E 03	4.666E 03	1.350E 04	3.699E 04	9.750E 04	2.601E 05
2400	7.763E 00	2.147E 01	5.928E 01	1.710E 02	5.197E 02	1.611E 03	5.005E 03	1.528E 04	4.487E 04	1.246E 05	3.304E 05
2600	9.114E 00	2.680E 01	7.573E 01	2.077E 02	5.802E 02	1.707E 03	5.222E 03	1.616E 04	4.945E 04	1.459E 05	4.073E 05
2800	9.715E 00	2.992E 01	8.952E 01	2.574E 02	7.113E 02	1.956E 03	5.618E 03	1.692E 04	5.204E 04	1.588E 05	4.675E 05
3000	1.005E 01	3.132E 01	9.695E 01	2.931E 02	8.522E 02	2.373E 03	6.493E 03	1.838E 04	5.472E 04	1.671E 05	5.066E 05
3200	1.082E 01	3.263E 01	1.009E 02	3.122E 02	9.482E 02	2.772E 03	7.745E 03	2.117E 04	5.952E 04	1.760E 05	5.341E 05
3400	1.271E 01	3.593E 01	1.061E 02	3.247E 02	1.002E 03	3.043E 03	8.895E 03	2.484E 04	6.783E 04	1.907E 05	5.626E 05
3600	1.494E 01	4.222E 01	1.184E 02	3.447E 02	1.044E 03	3.207E 03	9.703E 03	2.823E 04	7.643E 04	2.142E 05	6.048E 05
3800	1.646E 01	4.851E 01	1.378E 02	3.857E 02	1.113E 03	3.349E 03	1.023E 04	3.073E 04	8.850E 04	2.443E 05	6.690E 05
4000	1.739E 01	5.276E 01	1.558E 02	4.432E 02	1.246E 03	3.569E 03	1.069E 04	3.247E 04	9.658E 04	2.747E 05	7.521E 05
4200	1.837E 01	5.559E 01	1.802E 02	4.957E 02	1.408E 03	3.941E 03	1.136E 04	3.398E 04	1.025E 05	3.005E 05	8.412E 05
4400	2.002E 01	5.878E 01	1.771E 02	5.337E 02	1.565E 03	4.427E 03	1.241E 04	3.590E 04	1.074E 05	3.206E 05	9.231E 05
4600	2.216E 01	6.382E 01	1.871E 02	5.621E 02	1.684E 03	4.899E 03	1.378E 04	3.876E 04	1.129E 05	3.370E 05	9.916E 05
4800	2.403E 01	7.013E 01	2.018E 02	5.923E 02	1.776E 03	5.281E 03	1.520E 04	4.256E 04	1.205E 05	3.533E 05	1.048E 06
5000	2.543E 01	7.584E 01	2.203E 02	6.343E 02	1.866E 03	5.579E 03	1.643E 04	4.673E 04	1.306E 05	3.733E 05	1.099E 06
6000	2.835E 01	8.832E 01	2.755E 02	8.499E 02	2.563E 03	7.509E 03	2.154E 04	6.228E 04	1.829E 05	5.306E 05	1.493E 06
7000	3.101E 01	9.699E 01	3.003E 02	9.255E 02	2.867E 03	8.892E 03	2.720E 04	8.083E 04	2.330E 05	6.855E 05	1.924E 06
8000	3.188E 01	1.007E 02	3.179E 02	9.990E 02	3.112E 03	9.603E 03	2.959E 04	9.136E 04	2.787E 05	8.252E 05	2.367E 06

90C00	3-250E 01	1-030E 02	3-257E 02	1-029E 03	3-248E 03	1-021E 04	3-101E 04	9-812E 04	3-817E 05	9-249E 05	2-782E 06
100C00	3-327E 01	1-052E 02	3-327E 02	1-052E 03	3-325E 03	1-050E 04	3-311E 04	1-030E 05	3-221E 05	9-897E 05	3-029E 06
150C00	3-673E 01	1-161E 02	3-672E 02	1-161E 03	3-672E 03	1-161E 04	3-671E 04	1-161E 05	3-670E 05	1-160E 06	3-661E 06
200C00	4-192E 01	1-294E 02	4-054E 02	1-277E 03	4-031E 03	1-273E 04	4-020E 04	1-270E 05	4-016E 05	1-269E 06	4-012E 06
300C00	1-381E 02	3-965E 02	1-097E 03	3-068E 03	8-970E 03	2-669E 04	7-703E 04	2-698E 05	5-644E 05	1-607E 06	4-845E 06
400C00	1-750E 02	5-476E 02	1-694E 03	5-197E 03	1-600E 04	4-930E 04	1-409E 05	4-298E 05	1-188E 06	3-303E 06	9-478E 06
500C00	1-953E 02	5-859E 02	1-852E 03	5-854E 03	1-847E 04	5-810E 04	1-812E 05	5-802E 05	1-787E 06	5-208E 06	1-554E 07
600C00	1-944E 02	6-148E 02	1-944E 03	6-148E 03	1-944E 04	6-147E 04	1-943E 05	6-133E 05	1-930E 06	6-031E 06	1-860E 07
800C00	2-127E 02	6-720E 02	2-127E 03	6-726E 03	2-127E 04	6-724E 04	2-127E 05	6-724E 05	2-127E 06	6-724E 06	2-125E 07
1000C00	2-310E 02	7-305E 02	2-310E 03	7-305E 03	2-310E 04	7-305E 04	2-310E 05	7-304E 05	2-310E 06	7-304E 06	2-309E 07
1500C00	2-774E 02	8-760E 02	2-768E 03	8-751E 03	2-767E 04	8-750E 04	2-767E 05	8-750E 05	2-767E 06	8-750E 06	2-767E 07
2000C00	3-261E 02	1-031E 03	3-259E 03	1-030E 04	3-252E 04	1-026E 05	3-239E 05	1-022E 06	3-228E 06	1-020E 07	3-224E 07
3000C00	4-176E 02	1-321E 03	4-176E 03	1-321E 04	4-176E 04	1-321E 05	4-176E 05	1-321E 06	4-176E 06	1-320E 07	4-174E 07
4000C00	5-091E 02	1-610E 03	5-091E 03	1-610E 04	5-091E 04	1-610E 05	5-091E 05	1-610E 06	5-091E 06	1-610E 07	5-091E 07
5000C00	6-007E 02	1-899E 03	6-007E 03	1-899E 04	6-007E 04	1-899E 05	6-007E 05	1-899E 06	6-007E 06	1-899E 07	6-007E 07
6000C00	6-922E 02	2-189E 03	6-922E 03	2-189E 04	6-922E 04	2-189E 05	6-922E 05	2-189E 06	6-922E 06	2-189E 07	6-922E 07
8000C00	8-753E 02	2-768E 03	8-753E 03	2-768E 04	8-753E 04	2-768E 05	8-753E 05	2-768E 06	8-753E 06	2-768E 07	8-753E 07
10000C00	1-058E 03	3-347E 03	1-058E 04	3-347E 04	1-058E 05	3-347E 05	1-058E 06	3-347E 06	1-058E 07	3-347E 07	1-058E 08



TABLE 107(CUNT) INTERNAL ENERGY DENSITY (ERG/CM3) OF EQUILIBRIUM AIR

TEPP. (DEC K)	-3.5	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0
10000	2.242E 05	6.277E 05	1.832E 06	5.493E 06	1.672E 07	5.073E 07	1.493E 08	4.15CF 08	1.095E 09	2.840E 09
10500	2.564E 05	6.945E 05	1.969E 06	5.794E 06	1.746E 07	5.305E 07	1.588E 08	4.549E 08	1.229E 09	3.207E 09
11000	2.955E 05	7.783E 05	2.143E 06	6.163E 06	1.830E 07	5.532E 07	1.699E 08	4.890E 08	1.356E 09	3.585E 09
11500	3.400E 05	8.792E 05	2.357E 06	6.612E 06	1.928E 07	5.773E 07	1.743E 08	5.181E 08	1.472E 09	3.963E 09
12000	3.873E 05	9.950E 05	2.612E 06	7.131E 06	2.044E 07	6.040E 07	1.816E 08	5.438E 08	1.575E 09	4.327E 09
12500	4.341E 05	1.122E 06	2.906E 06	7.786E 06	2.180E 07	6.342E 07	1.892E 08	5.677E 08	1.667E 09	4.671E 09
13000	4.771E 05	1.253E 06	3.233E 06	8.516E 06	2.337E 07	6.686E 07	1.974E 08	5.909E 08	1.751E 09	4.990E 09
13500	5.141E 05	1.382E 06	3.583E 06	9.334E 06	2.516E 07	7.076E 07	2.063E 08	6.146E 08	1.829E 09	5.285E 09
14000	5.442E 05	1.502E 06	3.943E 06	1.023E 07	2.717E 07	7.517E 07	2.163E 08	6.393E 08	1.904E 09	5.559E 09
14500	5.678E 05	1.610E 06	4.301E 06	1.118E 07	2.939E 07	8.008E 07	2.273E 08	6.658E 08	1.979E 09	5.817E 09
15000	5.861E 05	1.701E 06	4.642E 06	1.216E 07	3.177E 07	8.549E 07	2.394E 08	6.943E 08	2.055E 09	6.065E 09
15500	6.002E 05	1.777E 06	4.957E 06	1.314E 07	3.430E 07	9.136E 07	2.526E 08	7.251E 08	2.134E 09	6.308E 09
16000	6.114E 05	1.838E 06	5.238E 06	1.410E 07	3.693E 07	9.765E 07	2.670E 08	7.583E 08	2.217E 09	6.550E 09
16500	6.205E 05	1.888E 06	5.483E 06	1.502E 07	3.959E 07	1.043E 08	2.824E 08	7.941E 08	2.303E 09	6.795E 09
17000	6.283E 05	1.929E 06	5.693E 06	1.587E 07	4.226E 07	1.112E 08	2.989E 08	8.324E 08	2.398E 09	7.047E 09
17500	6.352E 05	1.962E 06	5.871E 06	1.665E 07	4.486E 07	1.183E 08	3.162E 08	8.731E 08	2.496E 09	7.307E 09
18000	6.418E 05	1.991E 06	6.021E 06	1.735E 07	4.737E 07	1.255E 08	3.342E 08	9.160E 08	2.600E 09	7.577E 09
18500	6.484E 05	2.017E 06	6.149E 06	1.797E 07	4.975E 07	1.327E 08	3.528E 08	9.611E 08	2.709E 09	7.858E 09
19000	6.553E 05	2.040E 06	6.259E 06	1.852E 07	5.197E 07	1.397E 08	3.718E 08	1.008E 09	2.823E 09	8.156E 09
19500	6.630E 05	2.063E 06	6.356E 06	1.900E 07	5.403E 07	1.466E 08	3.910E 08	1.056E 09	2.942E 09	8.468E 09
20000	6.721E 05	2.085E 06	6.443E 06	1.942E 07	5.591E 07	1.533E 08	4.102E 08	1.106E 09	3.065E 09	8.793E 09
22000	7.358E 05	2.202E 06	6.761E 06	2.072E 07	6.187E 07	1.767E 08	4.846E 08	1.311E 09	3.591E 09	1.020E 10
24000	8.743E 05	2.433E 06	7.179E 06	2.182E 07	6.613E 07	1.947E 08	5.500E 08	1.511E 09	4.149E 09	1.171E 10
26000	1.082E 06	2.861E 06	7.421E 06	2.321E 07	6.988E 07	2.088E 08	6.046E 08	1.694E 09	4.693E 09	1.323E 10
28000	1.301E 06	3.452E 06	9.148E 06	2.541E 07	7.432E 07	2.215E 08	6.507E 08	1.857E 09	5.203E 09	1.470E 10
30000	1.478E 06	4.075E 06	1.078E 07	2.876E 07	8.058E 07	2.354E 08	6.932E 08	2.004E 09	5.672E 09	1.608E 10
32000	1.604E 06	4.612E 06	1.255E 07	3.314E 07	8.944E 07	2.531E 08	7.373E 08	2.142E 09	6.110E 09	1.739E 10
34000	1.696E 06	5.024E 06	1.417E 07	3.803E 07	1.008E 08	2.763E 08	7.883E 08	2.283E 09	6.531E 09	1.864E 10
36000	1.788E 06	5.340E 06	1.552E 07	4.283E 07	1.140E 08	3.054E 08	8.501E 08	2.435E 09	6.955E 09	1.986E 10
38000	1.904E 06	5.627E 06	1.661E 07	4.714E 07	1.276E 08	3.395E 08	9.248E 08	2.607E 09	7.400E 09	2.110E 10
40000	2.072E 06	5.957E 06	1.756E 07	5.082E 07	1.406E 08	3.763E 08	1.012E 09	2.803E 09	7.882E 09	2.238E 10
42000	2.293E 06	6.391E 06	1.852E 07	5.403E 07	1.526E 08	4.137E 08	1.108E 09	3.026E 09	8.413E 09	2.373E 10
44000	2.545E 06	6.956E 06	1.966E 07	5.704E 07	1.633E 08	4.498E 08	1.209E 09	3.272E 09	8.996E 09	2.518E 10
46000	2.796E 06	7.630E 06	2.107E 07	6.020E 07	1.731E 08	4.838E 08	1.311E 09	3.535E 09	9.632E 09	2.674E 10
48000	3.023E 06	8.353E 06	2.278E 07	6.380E 07	1.827E 08	5.156E 08	1.412E 09	3.809E 09	1.031E 10	2.840E 10
50000	3.218E 06	9.062E 06	2.472E 07	6.805E 07	1.926E 08	5.458E 08	1.509E 09	4.087E 09	1.103E 10	3.016E 10
60000	4.165E 06	1.188E 07	3.414E 07	9.533E 07	2.601E 08	7.103E 08	1.968E 09	5.441E 09	1.481E 10	4.000E 10
70000	5.531E 06	1.550E 07	4.300E 07	1.200E 08	3.390E 08	9.290E 08	2.516E 09	6.858E 09	1.873E 10	5.580E 10
80000	6.731E 06	1.925E 07	5.435E 07	1.503E 08	4.153E 08	1.151E 09	3.147E 09	8.517E 09	2.308E 10	6.258E 10

YUNUW	0.007E 00	2.672E 07	7.941E 07	2.134E 08	5.963E 08	1.638E 09	4.459E 09	1.211E 10	1.287E 10	0.880E 10
100000	0.143E 04	2.675E 07	7.941E 07	2.134E 08	5.963E 08	1.638E 09	4.459E 09	1.211E 10	1.287E 10	0.880E 10
150000	1.133E 07	3.604E 07	1.113E 08	3.370E 08	1.003E 09	2.889E 09	8.644E 09	2.210E 10	5.993E 10	1.420E 11
200000	1.207E 07	4.000E 07	1.259E 08	3.942E 08	1.220E 09	3.699E 09	1.091E 10	3.114E 10	8.542E 10	2.354E 11
300000	1.504E 07	4.719E 07	1.485E 08	4.673E 08	1.467E 09	4.579E 09	1.413E 10	4.272E 10	1.234E 11	3.554E 11
400000	2.704E 07	7.401E 07	2.012E 08	5.760E 08	1.734E 09	5.352E 09	1.656E 10	5.001E 10	1.330E 11	4.475E 11
500000	4.423E 07	1.217E 08	3.307E 08	9.515E 08	2.608E 09	7.110E 09	2.022E 10	5.909E 10	1.793E 11	5.349E 11
600000	5.648E 07	1.708E 08	4.990E 08	1.392E 09	3.817E 09	1.055E 10	2.805E 10	7.830E 10	2.190E 11	6.292E 11
800000	6.708E 07	2.111E 08	6.591E 08	2.027E 09	6.112E 09	1.795E 10	5.054E 10	1.380E 11	3.733E 11	1.091E 12
1000000	7.301E 07	2.308E 08	7.287E 08	2.290E 09	7.191E 09	2.223E 10	6.716E 10	1.967E 11	5.335E 11	1.503E 12
1500000	8.748E 07	2.766E 08	8.743E 08	2.763E 09	8.727E 09	2.753E 10	8.608E 10	2.788E 11	8.354E 11	2.313E 12
2000000	1.019E 08	3.223E 08	1.019E 09	3.221E 09	1.010E 10	3.214E 10	1.013E 11	3.180E 11	9.979E 11	3.093E 12
3000000	1.319E 08	4.164E 08	1.315E 09	4.149E 09	1.309E 10	4.133E 10	1.304E 11	4.111E 11	1.293E 12	4.050E 12
4000000	1.610E 08	5.091E 08	1.609E 09	5.088E 09	1.607E 10	5.075E 10	1.600E 11	5.042E 11	1.586E 12	4.901E 12
5000000	1.899E 08	6.004E 08	1.899E 09	6.003E 09	1.890E 10	5.999E 10	1.893E 11	5.979E 11	1.883E 12	5.910E 12
6000000	2.189E 08	6.921E 08	2.189E 09	6.920E 09	2.180E 10	6.916E 10	2.185E 11	6.902E 11	2.177E 12	6.853E 12
8000000	2.765E 08	8.752E 08	2.768E 09	8.751E 09	2.767E 10	8.748E 10	2.762E 11	8.734E 11	2.758E 12	8.698E 12
10000000	3.347E 08	1.059E 09	3.340E 09	1.058E 10	3.340E 10	1.058E 11	3.344E 11	1.057E 12	3.338E 12	1.054E 13

TABLE 108. ENTHALPY (ERG/GM) OF EQUILIBRIUM AIR

TEMP. (DEG K)	-9.0	-8.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.5	-5.0	-4.5	-4.0
10500	1.536E 12	1.536E 12	1.535E 12	1.532E 12	1.522E 12	1.495E 12	1.424E 12	1.280E 12	1.070E 12	8.775E 11	7.204E 11
10500	1.552E 12	1.552E 12	1.551E 12	1.550E 12	1.546E 12	1.533E 12	1.497E 12	1.409E 12	1.246E 12	1.030E 12	8.447E 11
11000	1.570E 12	1.568E 12	1.567E 12	1.566E 12	1.564E 12	1.550E 12	1.515E 12	1.491E 12	1.379E 12	1.194E 12	9.844E 11
11500	1.596E 12	1.587E 12	1.584E 12	1.583E 12	1.582E 12	1.570E 12	1.549E 12	1.542E 12	1.472E 12	1.330E 12	1.120E 12
12000	1.644E 12	1.614E 12	1.603E 12	1.600E 12	1.598E 12	1.596E 12	1.591E 12	1.574E 12	1.535E 12	1.435E 12	1.262E 12
12500	1.750E 12	1.662E 12	1.670E 12	1.619E 12	1.615E 12	1.613E 12	1.610E 12	1.602E 12	1.577E 12	1.512E 12	1.376E 12
13000	1.958E 12	1.761E 12	1.676E 12	1.645E 12	1.635E 12	1.631E 12	1.628E 12	1.623E 12	1.608E 12	1.564E 12	1.447E 12
13500	2.282E 12	1.947E 12	1.764E 12	1.687E 12	1.659E 12	1.650E 12	1.644E 12	1.641E 12	1.632E 12	1.605E 12	1.535E 12
14000	2.681E 12	2.234E 12	1.923E 12	1.762E 12	1.656E 12	1.672E 12	1.664E 12	1.660E 12	1.653E 12	1.635E 12	1.587E 12
14500	3.010E 12	2.583E 12	2.149E 12	1.892E 12	1.757E 12	1.704E 12	1.685E 12	1.678E 12	1.672E 12	1.660E 12	1.627E 12
15000	3.292E 12	2.925E 12	2.482E 12	2.095E 12	1.859E 12	1.753E 12	1.713E 12	1.698E 12	1.691E 12	1.681E 12	1.658E 12
15500	3.522E 12	3.217E 12	2.810E 12	2.364E 12	2.020E 12	1.831E 12	1.751E 12	1.722E 12	1.710E 12	1.702E 12	1.684E 12
16000	3.709E 12	3.457E 12	3.109E 12	2.668E 12	2.251E 12	1.952E 12	1.809E 12	1.753E 12	1.732E 12	1.721E 12	1.707E 12
16500	3.847E 12	3.656E 12	3.363E 12	2.966E 12	2.508E 12	2.124E 12	1.897E 12	1.796E 12	1.757E 12	1.742E 12	1.729E 12
17000	3.940E 12	3.811E 12	3.576E 12	3.233E 12	2.792E 12	2.344E 12	2.023E 12	1.858E 12	1.790E 12	1.764E 12	1.750E 12
17500	4.002E 12	3.923E 12	3.750E 12	3.463E 12	3.044E 12	2.597E 12	2.193E 12	1.947E 12	1.834E 12	1.790E 12	1.771E 12
18000	4.048E 12	3.999E 12	3.883E 12	3.656E 12	3.309E 12	2.859E 12	2.401E 12	2.069E 12	1.895E 12	1.823E 12	1.794E 12
18500	4.086E 12	4.054E 12	3.979E 12	3.813E 12	3.522E 12	3.111E 12	2.634E 12	2.226E 12	1.978E 12	1.865E 12	1.820E 12
19000	4.125E 12	4.097E 12	4.048E 12	3.934E 12	3.703E 12	3.341E 12	2.876E 12	2.415E 12	2.088E 12	1.920E 12	1.850E 12
19500	4.171E 12	4.137E 12	4.100E 12	4.023E 12	3.851E 12	3.544E 12	3.112E 12	2.626E 12	2.237E 12	1.994E 12	1.869E 12
20000	4.231E 12	4.178E 12	4.144E 12	4.090E 12	3.967E 12	3.719E 12	3.331E 12	2.847E 12	2.392E 12	2.088E 12	1.937E 12
22000	4.948E 12	4.534E 12	4.351E 12	4.276E 12	4.227E 12	4.148E 12	3.973E 12	3.648E 12	3.183E 12	2.679E 12	2.284E 12
24000	6.502E 12	5.717E 12	5.025E 12	4.616E 12	4.434E 12	4.354E 12	4.280E 12	4.145E 12	3.855E 12	3.407E 12	2.884E 12
26000	7.628E 12	7.114E 12	6.386E 12	5.576E 12	4.937E 12	4.631E 12	4.488E 12	4.397E 12	4.261E 12	3.988E 12	3.541E 12
28000	8.154E 12	7.950E 12	7.338E 12	6.880E 12	6.050E 12	5.300E 12	4.650E 12	4.425E 12	4.504E 12	4.353E 12	4.064E 12
30000	8.469E 12	8.347E 12	8.179E 12	7.834E 12	7.229E 12	6.403E 12	5.583E 12	5.030E 12	4.753E 12	4.599E 12	4.418E 12
32000	9.126E 12	8.723E 12	8.536E 12	8.364E 12	8.047E 12	7.464E 12	6.635E 12	5.779E 12	5.176E 12	4.861E 12	4.675E 12
34000	1.069E 13	9.604E 12	9.004E 12	8.726E 12	8.525E 12	8.201E 12	7.609E 12	6.759E 12	5.895E 12	5.270E 12	4.940E 12
36000	1.253E 13	1.125E 13	1.003E 13	9.276E 12	8.908E 12	8.664E 12	8.366E 12	7.671E 12	6.766E 12	5.911E 12	5.315E 12
38000	1.390E 13	1.290E 13	1.144E 13	1.036E 13	9.505E 12	9.047E 12	8.775E 12	8.358E 12	7.452E 12	6.725E 12	5.874E 12
40000	1.459E 13	1.403E 13	1.313E 13	1.188E 13	1.037E 13	9.672E 12	9.193E 12	8.847E 12	8.366E 12	7.548E 12	6.584E 12
42000	1.544E 13	1.480E 13	1.419E 13	1.326E 13	1.198E 13	1.067E 13	9.771E 12	9.275E 12	8.868E 12	8.255E 12	7.357E 12
44000	1.622E 13	1.567E 13	1.496E 13	1.429E 13	1.339E 13	1.196E 13	1.067E 13	9.811E 12	9.309E 12	8.816E 12	8.068E 12
46000	1.860E 13	1.700E 13	1.592E 13	1.506E 13	1.431E 13	1.321E 13	1.183E 13	1.059E 13	9.801E 12	9.282E 12	8.631E 12
48000	2.014E 13	1.866E 13	1.704E 13	1.589E 13	1.510E 13	1.424E 13	1.303E 13	1.161E 13	1.046E 13	9.744E 12	9.175E 12
50000	2.134E 13	2.018E 13	1.860E 13	1.701E 13	1.588E 13	1.506E 13	1.407E 13	1.273E 13	1.133E 13	1.030E 13	9.636E 12
60000	2.401E 13	2.367E 13	2.336E 13	2.202E 13	2.101E 13	2.028E 13	1.849E 13	1.699E 13	1.504E 13	1.460E 13	1.308E 13
70000	2.648E 13	2.621E 13	2.549E 13	2.507E 13	2.459E 13	2.414E 13	2.339E 13	2.205E 13	2.020E 13	1.835E 13	1.687E 13
80000	2.732E 13	2.750E 13	2.744E 13	2.728E 13	2.690E 13	2.629E 13	2.566E 13	2.502E 13	2.424E 13	2.278E 13	2.078E 13

98000	2.8418	13	6.8748	13	2.9308	13	2.9298	13	2.9268	13	2.9178	13	2.8978	13	6.8748	13	3.3712	13	3.3458	13
100000	2.9308	13	2.9308	13	2.9308	13	2.9308	13	2.9308	13	2.9308	13	2.9308	13	2.9308	13	2.9308	13	2.9308	13
150000	3.3768	13	3.3758	13	3.3758	13	3.3758	13	3.3758	13	3.3758	13	3.3758	13	3.3758	13	3.3758	13	3.3758	13
200000	3.9408	13	3.8798	13	3.8498	13	3.8318	13	3.8268	13	3.8228	13	3.8208	13	3.8198	13	3.8178	13	3.8158	13
300000	1.7038	14	1.1018	14	0.7538	13	0.1918	13	7.7258	13	7.1298	13	6.2678	13	5.4608	13	5.0128	13	4.8218	13
400000	1.5438	14	1.3288	14	1.4978	14	1.4228	14	1.3098	14	1.3328	14	1.2278	14	1.0008	14	9.7208	13	8.9348	13
500000	1.6498	14	1.6498	14	1.6498	14	1.6498	14	1.6498	14	1.6498	14	1.6498	14	1.6498	14	1.6498	14	1.6498	14
600000	1.7878	14	1.7878	14	1.7878	14	1.7878	14	1.7878	14	1.7878	14	1.7878	14	1.7878	14	1.7878	14	1.7878	14
800000	2.0238	14	2.0238	14	2.0238	14	2.0238	14	2.0238	14	2.0238	14	2.0238	14	2.0238	14	2.0238	14	2.0238	14
1000000	2.2598	14	2.2598	14	2.2598	14	2.2598	14	2.2598	14	2.2598	14	2.2598	14	2.2598	14	2.2598	14	2.2598	14
1200000	2.8548	14	2.8518	14	2.8508	14	2.8498	14	2.8498	14	2.8498	14	2.8498	14	2.8498	14	2.8498	14	2.8498	14
1400000	3.4478	14	3.4378	14	3.4408	14	3.4408	14	3.4408	14	3.4408	14	3.4408	14	3.4408	14	3.4408	14	3.4408	14
1600000	4.0408	14	4.0408	14	4.0408	14	4.0408	14	4.0408	14	4.0408	14	4.0408	14	4.0408	14	4.0408	14	4.0408	14
1800000	5.0288	14	5.0288	14	5.0288	14	5.0288	14	5.0288	14	5.0288	14	5.0288	14	5.0288	14	5.0288	14	5.0288	14
2000000	7.0098	14	7.0098	14	7.0098	14	7.0098	14	7.0098	14	7.0098	14	7.0098	14	7.0098	14	7.0098	14	7.0098	14
2200000	8.1898	14	8.1898	14	8.1898	14	8.1898	14	8.1898	14	8.1898	14	8.1898	14	8.1898	14	8.1898	14	8.1898	14
2400000	1.0558	15	1.0558	15	1.0558	15	1.0558	15	1.0558	15	1.0558	15	1.0558	15	1.0558	15	1.0558	15	1.0558	15
2600000	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15
2800000	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15
3000000	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15	1.2918	15

TABLE 10B(CONT) ENTHALPY (ERG/CM) OF EQUILIBRIUM AIR

TEMP. (DEG K)	LOG DENSITY RATIO										
	-3.5	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	
10500	4.141E 11	5.477E 11	5.078E 11	4.936E 11	4.668E 11	4.409E 11	4.195E 11	3.710E 11	3.137E 11	2.615E 11	
10800	7.004E 11	6.031E 11	5.462E 11	5.108E 11	4.885E 11	4.704E 11	4.449E 11	4.071E 11	3.512E 11	2.939E 11	
11000	8.040E 11	6.766E 11	5.941E 11	5.366E 11	5.128E 11	4.917E 11	4.704E 11	4.378E 11	3.809E 11	3.275E 11	
11500	9.237E 11	7.624E 11	6.524E 11	5.931E 11	5.408E 11	5.140E 11	4.924E 11	4.644E 11	4.190E 11	3.611E 11	
12000	1.050E 12	8.610E 11	7.216E 11	6.301E 11	5.735E 11	5.384E 11	5.130E 11	4.802E 11	4.454E 11	3.930E 11	
12500	1.176E 12	9.688E 11	8.012E 11	6.952E 11	6.114E 11	5.658E 11	5.360E 11	5.104E 11	4.762E 11	4.240E 11	
13000	1.293E 12	1.081E 12	8.897E 11	7.804E 11	6.551E 11	5.967E 11	5.599E 11	5.321E 11	5.006E 11	4.539E 11	
13500	1.394E 12	1.192E 12	9.847E 11	8.591E 11	7.047E 11	6.316E 11	5.850E 11	5.542E 11	5.235E 11	4.809E 11	
14000	1.478E 12	1.296E 12	1.083E 12	9.622E 11	7.602E 11	6.707E 11	6.143E 11	5.771E 11	5.457E 11	5.042E 11	
14500	1.545E 12	1.399E 12	1.181E 12	9.783E 11	8.212E 11	7.141E 11	6.454E 11	6.015E 11	5.676E 11	5.302E 11	
15000	1.598E 12	1.470E 12	1.275E 12	1.063E 12	8.870E 11	7.617E 11	6.800E 11	6.276E 11	5.902E 11	5.535E 11	
15500	1.640E 12	1.538E 12	1.362E 12	1.149E 12	9.568E 11	8.134E 11	7.174E 11	6.554E 11	6.134E 11	5.759E 11	
16000	1.674E 12	1.594E 12	1.440E 12	1.233E 12	1.029E 12	8.687E 11	7.578E 11	6.857E 11	6.376E 11	5.965E 11	
16500	1.703E 12	1.640E 12	1.510E 12	1.314E 12	1.103E 12	9.272E 11	8.012E 11	7.160E 11	6.631E 11	6.213E 11	
17000	1.729E 12	1.679E 12	1.570E 12	1.390E 12	1.177E 12	9.881E 11	8.473E 11	7.524E 11	6.900E 11	6.444E 11	
17500	1.752E 12	1.712E 12	1.622E 12	1.459E 12	1.250E 12	1.051E 12	8.959E 11	7.899E 11	7.195E 11	6.686E 11	
18000	1.774E 12	1.741E 12	1.667E 12	1.523E 12	1.321E 12	1.114E 12	9.445E 11	8.275E 11	7.400E 11	6.934E 11	
18500	1.794E 12	1.767E 12	1.705E 12	1.579E 12	1.388E 12	1.178E 12	9.908E 11	8.678E 11	7.793E 11	7.191E 11	
19000	1.819E 12	1.792E 12	1.739E 12	1.630E 12	1.451E 12	1.241E 12	1.052E 12	9.090E 11	8.119E 11	7.442E 11	
19500	1.845E 12	1.816E 12	1.770E 12	1.675E 12	1.511E 12	1.303E 12	1.107E 12	9.531E 11	8.459E 11	7.742E 11	
20000	1.873E 12	1.840E 12	1.798E 12	1.715E 12	1.565E 12	1.363E 12	1.161E 12	9.977E 11	8.811E 11	8.039E 11	
20500	2.059E 12	1.936E 12	1.902E 12	1.844E 12	1.743E 12	1.578E 12	1.374E 12	1.182E 12	1.031E 12	9.304E 11	
21000	2.440E 12	2.166E 12	2.031E 12	1.956E 12	1.876E 12	1.748E 12	1.565E 12	1.365E 12	1.191E 12	1.066E 12	
21500	3.005E 12	2.540E 12	2.245E 12	2.091E 12	1.995E 12	1.866E 12	1.729E 12	1.536E 12	1.349E 12	1.204E 12	
22000	3.600E 12	3.052E 12	2.587E 12	2.294E 12	2.132E 12	2.013E 12	1.871E 12	1.691E 12	1.499E 12	1.339E 12	
22500	4.093E 12	3.593E 12	3.038E 12	2.593E 12	2.316E 12	2.149E 12	2.004E 12	1.833E 12	1.640E 12	1.448E 12	
23000	4.450E 12	4.066E 12	3.526E 12	2.979E 12	2.570E 12	2.316E 12	2.140E 12	1.968E 12	1.773E 12	1.592E 12	
23500	4.722E 12	4.434E 12	3.980E 12	3.409E 12	2.892E 12	2.530E 12	2.295E 12	2.105E 12	1.902E 12	1.711E 12	
24000	4.986E 12	4.728E 12	4.363E 12	3.835E 12	3.260E 12	2.794E 12	2.478E 12	2.251E 12	2.032E 12	1.829E 12	
24500	5.323E 12	4.994E 12	4.679E 12	4.222E 12	3.644E 12	3.100E 12	2.695E 12	2.414E 12	2.148E 12	1.948E 12	
25000	5.793E 12	5.299E 12	4.951E 12	4.558E 12	4.016E 12	3.431E 12	2.945E 12	2.598E 12	2.314E 12	2.072E 12	
25500	6.400E 12	5.688E 12	5.241E 12	4.855E 12	4.359E 12	3.768E 12	3.221E 12	2.804E 12	2.472E 12	2.201E 12	
26000	7.090E 12	6.185E 12	5.568E 12	5.135E 12	4.671E 12	4.094E 12	3.512E 12	3.030E 12	2.645E 12	2.339E 12	
26500	7.780E 12	6.775E 12	5.969E 12	5.428E 12	4.940E 12	4.400E 12	3.807E 12	3.272E 12	2.833E 12	2.486E 12	
27000	8.409E 12	7.407E 12	6.449E 12	5.798E 12	5.241E 12	4.703E 12	4.099E 12	3.523E 12	3.032E 12	2.642E 12	
27500	8.950E 12	8.030E 12	6.991E 12	6.141E 12	5.533E 12	4.984E 12	4.383E 12	3.780E 12	3.262E 12	2.807E 12	
28000	1.163E 13	1.036E 13	9.649E 12	8.598E 12	7.471E 12	6.510E 12	5.742E 12	5.045E 12	4.350E 12	3.720E 12	
28500	1.542E 13	1.376E 13	1.210E 13	1.091E 13	9.736E 12	8.505E 12	7.348E 12	6.376E 12	5.530E 12	4.746E 12	
29000	1.881E 13	1.711E 13	1.538E 13	1.356E 13	1.195E 13	1.055E 13	9.191E 12	7.924E 12	6.827E 12	5.850E 12	

150000	3.351E 13	3.316E 13	3.243E 13	3.110E 13	2.937E 13	2.808E 13	2.688E 13	2.580E 13	2.481E 13	2.392E 13	2.313E 13	2.244E 13
200000	3.811E 13	3.803E 13	3.709E 13	3.740E 13	3.670E 13	3.524E 13	3.394E 13	3.279E 13	3.180E 13	3.091E 13	2.992E 13	2.903E 13
300000	4.749E 13	4.717E 13	4.690E 13	4.674E 13	4.640E 13	4.560E 13	4.445E 13	4.346E 13	4.247E 13	4.148E 13	4.049E 13	3.950E 13
400000	5.177E 13	7.234E 13	6.389E 13	5.800E 13	5.662E 13	5.541E 13	5.430E 13	5.329E 13	5.228E 13	5.127E 13	5.026E 13	4.925E 13
500000	1.300E 14	1.151E 14	1.030E 14	9.317E 13	8.264E 13	7.316E 13	6.709E 13	6.351E 13	6.050E 13	5.792E 13	5.534E 13	5.276E 13
600000	1.663E 14	1.594E 14	1.484E 14	1.332E 14	1.170E 14	1.052E 14	9.307E 13	8.205E 13	7.413E 13	6.729E 13	6.046E 13	5.363E 13
800000	2.018E 14	2.010E 14	1.907E 14	1.939E 14	1.840E 14	1.743E 14	1.577E 14	1.389E 14	1.217E 14	1.052E 13	8.858E 12	7.164E 12
1000000	2.250E 14	2.257E 14	2.254E 14	2.264E 14	2.227E 14	2.183E 14	2.097E 14	1.961E 14	1.771E 14	1.571E 14	1.353E 14	1.125E 14
1500000	2.848E 14	2.847E 14	2.846E 14	2.845E 14	2.841E 14	2.834E 14	2.820E 14	2.791E 14	2.729E 14	2.608E 14	2.487E 14	2.366E 14
2000000	3.430E 14	3.437E 14	3.434E 14	3.435E 14	3.432E 14	3.427E 14	3.410E 14	3.401E 14	3.369E 14	3.306E 14	3.243E 14	3.180E 14
3000000	4.644E 14	4.639E 14	4.633E 14	4.635E 14	4.610E 14	4.611E 14	4.602E 14	4.589E 14	4.566E 14	4.526E 14	4.486E 14	4.446E 14
4000000	5.820E 14	5.820E 14	5.827E 14	5.829E 14	5.821E 14	5.813E 14	5.800E 14	5.783E 14	5.750E 14	5.721E 14	5.692E 14	5.663E 14
5000000	7.009E 14	7.000E 14	7.000E 14	7.007E 14	7.005E 14	7.001E 14	6.995E 14	6.982E 14	6.959E 14	6.921E 14	6.883E 14	6.845E 14
6000000	8.189E 14	8.189E 14	8.180E 14	8.187E 14	8.186E 14	8.183E 14	8.170E 14	8.160E 14	8.131E 14	8.119E 14	8.119E 14	8.119E 14
8000000	1.055E 15	1.055E 15	1.055E 15	1.055E 15	1.055E 15	1.054E 15	1.054E 15	1.054E 15	1.052E 15	1.049E 15	1.049E 15	1.049E 15
10000000	1.291E 15	1.291E 15	1.291E 15	1.291E 15	1.291E 15	1.291E 15	1.290E 15	1.290E 15	1.288E 15	1.288E 15	1.288E 15	1.288E 15

TABLE 109. EFFECTIVE GAMMA-1 - P/V/E OF EQUILIBRIUM AIR

TEMP. (DEG K)	-9.0	-8.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.5	-5.0	-4.5	-4.0
1000	0.030E-02	0.039E-02	0.040E-02	0.043E-02	0.040E-02	0.105E-02	0.232E-02	0.535E-02	9.105E-02	9.946E-02	1.051E-01
1050	0.300E-02	0.302E-02	0.303E-02	0.305E-02	0.301E-02	0.711E-02	0.472E-02	0.630E-02	9.012E-02	9.649E-02	1.051E-01
1100	0.709E-02	0.710E-02	0.721E-02	0.722E-02	0.725E-02	0.734E-02	0.764E-02	0.831E-02	9.076E-02	9.545E-02	1.031E-01
1150	0.005E-02	0.039E-02	0.050E-02	0.054E-02	0.057E-02	0.061E-02	0.074E-02	0.121E-02	9.251E-02	9.502E-02	1.015E-01
1200	0.207E-02	0.325E-02	0.365E-02	0.379E-02	0.383E-02	0.387E-02	0.394E-02	0.410E-02	9.491E-02	9.608E-02	1.012E-01
1250	0.201E-02	0.519E-02	0.645E-02	0.679E-02	0.703E-02	0.708E-02	0.713E-02	0.726E-02	9.767E-02	9.877E-02	1.011E-01
1300	0.898E-02	0.524E-02	0.042E-02	0.044E-02	1.001E-01	1.002E-01	1.003E-01	1.004E-01	1.004E-01	1.004E-01	1.003E-01
1350	0.418E-02	0.267E-02	0.074E-02	1.027E-01	1.039E-01	1.033E-01	1.034E-01	1.035E-01	1.034E-01	1.040E-01	1.051E-01
1400	7.999E-02	0.031E-02	0.081E-02	1.025E-01	1.031E-01	1.061E-01	1.064E-01	1.065E-01	1.064E-01	1.069E-01	1.077E-01
1450	7.755E-02	0.412E-02	0.301E-02	1.013E-01	1.063E-01	1.084E-01	1.092E-01	1.095E-01	1.094E-01	1.098E-01	1.103E-01
1500	7.656E-02	0.132E-02	0.089E-02	0.820E-02	1.039E-01	1.100E-01	1.110E-01	1.123E-01	1.124E-01	1.127E-01	1.130E-01
1550	7.637E-02	7.944E-02	0.572E-02	0.433E-02	1.037E-01	1.104E-01	1.137E-01	1.150E-01	1.154E-01	1.156E-01	1.158E-01
1600	7.672E-02	7.940E-02	0.384E-02	0.080E-02	1.004E-01	1.093E-01	1.140E-01	1.172E-01	1.181E-01	1.184E-01	1.184E-01
1650	7.760E-02	7.940E-02	0.299E-02	0.047E-02	0.609E-02	1.069E-01	1.140E-01	1.189E-01	1.204E-01	1.212E-01	1.214E-01
1700	7.894E-02	0.024E-02	0.202E-02	0.710E-02	0.400E-02	1.037E-01	1.134E-01	1.190E-01	1.227E-01	1.237E-01	1.241E-01
1750	0.055E-02	0.135E-02	0.317E-02	0.652E-02	0.203E-02	1.006E-01	1.109E-01	1.195E-01	1.242E-01	1.261E-01	1.268E-01
1800	0.230E-02	0.280E-02	0.400E-02	0.652E-02	0.911E-02	0.802E-02	1.006E-01	1.182E-01	1.250E-01	1.281E-01	1.293E-01
1850	0.409E-02	0.444E-02	0.521E-02	0.699E-02	0.045E-02	0.627E-02	1.052E-01	1.140E-01	1.240E-01	1.296E-01	1.314E-01
1900	0.584E-02	0.617E-02	0.660E-02	0.709E-02	0.051E-02	0.523E-02	1.029E-01	1.134E-01	1.230E-01	1.305E-01	1.330E-01
1950	0.748E-02	0.791E-02	0.031E-02	0.912E-02	0.102E-02	0.478E-02	1.012E-01	1.100E-01	1.220E-01	1.307E-01	1.352E-01
2000	0.888E-02	0.950E-02	0.000E-02	0.059E-02	0.191E-02	0.402E-02	1.001E-01	1.084E-01	1.197E-01	1.300E-01	1.343E-01
2050	0.850E-02	0.344E-02	0.591E-02	0.642E-02	0.751E-02	0.847E-02	1.005E-01	1.047E-01	1.120E-01	1.228E-01	1.347E-01
2100	0.235E-02	0.845E-02	0.547E-02	1.006E-01	1.032E-01	1.043E-01	1.053E-01	1.069E-01	1.105E-01	1.173E-01	1.270E-01
2150	0.168E-02	0.472E-02	0.979E-02	0.694E-02	1.041E-01	1.086E-01	1.107E-01	1.119E-01	1.134E-01	1.170E-01	1.237E-01
2200	0.464E-02	0.579E-02	0.019E-02	0.254E-02	0.933E-02	1.073E-01	1.135E-01	1.167E-01	1.184E-01	1.203E-01	1.240E-01
2250	0.351E-02	0.290E-02	0.025E-02	0.227E-02	0.623E-02	1.028E-01	1.112E-01	1.144E-01	1.224E-01	1.248E-01	1.270E-01
2300	0.982E-02	0.250E-02	0.374E-02	0.401E-02	0.671E-02	1.005E-01	1.071E-01	1.150E-01	1.237E-01	1.285E-01	1.312E-01
2350	0.637E-02	0.220E-02	0.015E-02	0.809E-02	0.937E-02	1.014E-01	1.054E-01	1.122E-01	1.213E-01	1.296E-01	1.346E-01
2400	0.324E-02	0.857E-02	0.491E-02	0.973E-02	1.023E-01	1.039E-01	1.062E-01	1.106E-01	1.181E-01	1.277E-01	1.359E-01
2450	0.316E-02	0.631E-02	0.150E-02	0.808E-02	1.035E-01	1.066E-01	1.086E-01	1.113E-01	1.164E-01	1.248E-01	1.347E-01
2500	0.471E-02	0.659E-02	0.978E-02	0.504E-02	1.018E-01	1.076E-01	1.110E-01	1.134E-01	1.168E-01	1.229E-01	1.323E-01
2550	0.594E-02	0.810E-02	0.019E-02	0.359E-02	0.913E-02	1.061E-01	1.120E-01	1.154E-01	1.184E-01	1.227E-01	1.302E-01
2600	0.545E-02	0.914E-02	0.154E-02	0.397E-02	0.775E-02	1.030E-01	1.110E-01	1.168E-01	1.205E-01	1.239E-01	1.295E-01
2650	0.422E-02	0.068E-02	0.256E-02	0.523E-02	0.777E-02	1.023E-01	1.090E-01	1.164E-01	1.219E-01	1.256E-01	1.300E-01
2700	0.391E-02	0.760E-02	0.224E-02	0.622E-02	0.908E-02	1.023E-01	1.074E-01	1.147E-01	1.220E-01	1.272E-01	1.313E-01
2750	0.459E-02	0.727E-02	0.132E-02	0.615E-02	1.001E-01	1.032E-01	1.071E-01	1.131E-01	1.210E-01	1.279E-01	1.320E-01
2800	0.451E-02	0.537E-02	0.610E-02	0.735E-02	0.977E-02	1.030E-01	1.093E-01	1.147E-01	1.193E-01	1.245E-01	1.321E-01
2850	1.035E-01	1.042E-01	1.055E-01	1.071E-01	1.084E-01	1.094E-01	1.114E-01	1.150E-01	1.204E-01	1.271E-01	1.330E-01
2900	1.153E-01	1.154E-01	1.155E-01	1.159E-01	1.170E-01	1.187E-01	1.204E-01	1.220E-01	1.242E-01	1.262E-01	1.345E-01





TABLE 109(CONT) EFFECTIVE GAMMA-1 - P/V/E OF EQUILIBRIUM AIR

TEMP. (DEG K)	-3.5	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0
10000	1.194E-01	1.277E-01	1.337E-01	1.379E-01	1.408E-01	1.437E-01	1.464E-01	1.570E-01	1.711E-01	1.895E-01
10500	1.162E-01	1.259E-01	1.337E-01	1.394E-01	1.432E-01	1.463E-01	1.499E-01	1.564E-01	1.678E-01	1.843E-01
11000	1.129E-01	1.234E-01	1.327E-01	1.399E-01	1.450E-01	1.484E-01	1.520E-01	1.571E-01	1.681E-01	1.803E-01
11500	1.102E-01	1.207E-01	1.310E-01	1.377E-01	1.441E-01	1.504E-01	1.542E-01	1.584E-01	1.694E-01	1.776E-01
12000	1.084E-01	1.182E-01	1.289E-01	1.387E-01	1.465E-01	1.521E-01	1.562E-01	1.632E-01	1.640E-01	1.740E-01
12500	1.075E-01	1.162E-01	1.267E-01	1.373E-01	1.463E-01	1.530E-01	1.579E-01	1.620E-01	1.670E-01	1.754E-01
13000	1.074E-01	1.149E-01	1.248E-01	1.356E-01	1.456E-01	1.533E-01	1.593E-01	1.638E-01	1.684E-01	1.754E-01
13500	1.084E-01	1.144E-01	1.233E-01	1.339E-01	1.445E-01	1.532E-01	1.602E-01	1.653E-01	1.699E-01	1.740E-01
14000	1.099E-01	1.146E-01	1.223E-01	1.324E-01	1.433E-01	1.531E-01	1.608E-01	1.645E-01	1.713E-01	1.768E-01
14500	1.110E-01	1.154E-01	1.219E-01	1.313E-01	1.420E-01	1.524E-01	1.610E-01	1.675E-01	1.726E-01	1.778E-01
15000	1.141E-01	1.167E-01	1.221E-01	1.304E-01	1.408E-01	1.515E-01	1.608E-01	1.691E-01	1.737E-01	1.789E-01
15500	1.165E-01	1.184E-01	1.227E-01	1.301E-01	1.399E-01	1.506E-01	1.605E-01	1.685E-01	1.746E-01	1.799E-01
16000	1.191E-01	1.205E-01	1.238E-01	1.301E-01	1.391E-01	1.497E-01	1.599E-01	1.686E-01	1.753E-01	1.808E-01
16500	1.217E-01	1.227E-01	1.253E-01	1.306E-01	1.387E-01	1.489E-01	1.593E-01	1.685E-01	1.758E-01	1.815E-01
17000	1.244E-01	1.251E-01	1.271E-01	1.314E-01	1.386E-01	1.483E-01	1.587E-01	1.682E-01	1.760E-01	1.821E-01
17500	1.271E-01	1.274E-01	1.290E-01	1.325E-01	1.389E-01	1.478E-01	1.580E-01	1.678E-01	1.760E-01	1.824E-01
18000	1.297E-01	1.301E-01	1.312E-01	1.339E-01	1.394E-01	1.476E-01	1.575E-01	1.674E-01	1.759E-01	1.824E-01
18500	1.322E-01	1.326E-01	1.334E-01	1.354E-01	1.402E-01	1.476E-01	1.570E-01	1.669E-01	1.757E-01	1.827E-01
19000	1.347E-01	1.351E-01	1.357E-01	1.374E-01	1.413E-01	1.479E-01	1.568E-01	1.664E-01	1.754E-01	1.824E-01
19500	1.370E-01	1.376E-01	1.381E-01	1.394E-01	1.426E-01	1.484E-01	1.564E-01	1.662E-01	1.750E-01	1.820E-01
20000	1.390E-01	1.400E-01	1.405E-01	1.415E-01	1.441E-01	1.491E-01	1.567E-01	1.657E-01	1.746E-01	1.815E-01
20500	1.404E-01	1.409E-01	1.415E-01	1.425E-01	1.451E-01	1.501E-01	1.577E-01	1.667E-01	1.756E-01	1.825E-01
21000	1.424E-01	1.429E-01	1.435E-01	1.445E-01	1.471E-01	1.521E-01	1.597E-01	1.687E-01	1.776E-01	1.845E-01
21500	1.443E-01	1.448E-01	1.454E-01	1.464E-01	1.490E-01	1.540E-01	1.616E-01	1.706E-01	1.795E-01	1.864E-01
22000	1.463E-01	1.468E-01	1.474E-01	1.484E-01	1.510E-01	1.560E-01	1.636E-01	1.726E-01	1.815E-01	1.902E-01
22500	1.482E-01	1.487E-01	1.493E-01	1.503E-01	1.529E-01	1.579E-01	1.655E-01	1.745E-01	1.834E-01	1.922E-01
23000	1.502E-01	1.507E-01	1.513E-01	1.523E-01	1.549E-01	1.599E-01	1.675E-01	1.765E-01	1.854E-01	1.942E-01
23500	1.521E-01	1.526E-01	1.532E-01	1.542E-01	1.568E-01	1.618E-01	1.694E-01	1.784E-01	1.873E-01	1.961E-01
24000	1.541E-01	1.546E-01	1.552E-01	1.562E-01	1.588E-01	1.638E-01	1.714E-01	1.804E-01	1.893E-01	1.981E-01
24500	1.560E-01	1.565E-01	1.571E-01	1.581E-01	1.607E-01	1.657E-01	1.733E-01	1.823E-01	1.912E-01	2.000E-01
25000	1.580E-01	1.585E-01	1.591E-01	1.601E-01	1.627E-01	1.677E-01	1.753E-01	1.843E-01	1.932E-01	2.020E-01
25500	1.600E-01	1.605E-01	1.611E-01	1.621E-01	1.647E-01	1.697E-01	1.773E-01	1.863E-01	1.952E-01	2.040E-01
26000	1.620E-01	1.625E-01	1.631E-01	1.641E-01	1.667E-01	1.717E-01	1.793E-01	1.883E-01	1.972E-01	2.060E-01
26500	1.640E-01	1.645E-01	1.651E-01	1.661E-01	1.687E-01	1.737E-01	1.813E-01	1.903E-01	1.992E-01	2.080E-01
27000	1.660E-01	1.665E-01	1.671E-01	1.681E-01	1.707E-01	1.757E-01	1.833E-01	1.923E-01	2.012E-01	2.100E-01
27500	1.680E-01	1.685E-01	1.691E-01	1.701E-01	1.727E-01	1.777E-01	1.853E-01	1.943E-01	2.032E-01	2.120E-01
28000	1.700E-01	1.705E-01	1.711E-01	1.721E-01	1.747E-01	1.797E-01	1.873E-01	1.963E-01	2.052E-01	2.140E-01
28500	1.720E-01	1.725E-01	1.731E-01	1.741E-01	1.767E-01	1.817E-01	1.893E-01	1.983E-01	2.072E-01	2.160E-01
29000	1.740E-01	1.745E-01	1.751E-01	1.761E-01	1.787E-01	1.837E-01	1.913E-01	2.003E-01	2.092E-01	2.180E-01
29500	1.760E-01	1.765E-01	1.771E-01	1.781E-01	1.807E-01	1.857E-01	1.933E-01	2.023E-01	2.112E-01	2.200E-01
30000	1.780E-01	1.785E-01	1.791E-01	1.801E-01	1.827E-01	1.877E-01	1.953E-01	2.043E-01	2.132E-01	2.220E-01
30500	1.800E-01	1.805E-01	1.811E-01	1.821E-01	1.847E-01	1.897E-01	1.973E-01	2.063E-01	2.152E-01	2.240E-01
31000	1.820E-01	1.825E-01	1.831E-01	1.841E-01	1.867E-01	1.917E-01	1.993E-01	2.083E-01	2.172E-01	2.260E-01
31500	1.840E-01	1.845E-01	1.851E-01	1.861E-01	1.887E-01	1.937E-01	2.013E-01	2.103E-01	2.192E-01	2.280E-01
32000	1.860E-01	1.865E-01	1.871E-01	1.881E-01	1.907E-01	1.957E-01	2.033E-01	2.123E-01	2.212E-01	2.300E-01
32500	1.880E-01	1.885E-01	1.891E-01	1.901E-01	1.927E-01	1.977E-01	2.053E-01	2.143E-01	2.232E-01	2.320E-01
33000	1.900E-01	1.905E-01	1.911E-01	1.921E-01	1.947E-01	1.997E-01	2.073E-01	2.163E-01	2.252E-01	2.340E-01
33500	1.920E-01	1.925E-01	1.931E-01	1.941E-01	1.967E-01	2.017E-01	2.093E-01	2.183E-01	2.272E-01	2.360E-01
34000	1.940E-01	1.945E-01	1.951E-01	1.961E-01	1.987E-01	2.037E-01	2.113E-01	2.203E-01	2.292E-01	2.380E-01
34500	1.960E-01	1.965E-01	1.971E-01	1.981E-01	2.007E-01	2.057E-01	2.133E-01	2.223E-01	2.312E-01	2.400E-01
35000	1.980E-01	1.985E-01	1.991E-01	2.001E-01	2.027E-01	2.077E-01	2.153E-01	2.243E-01	2.332E-01	2.420E-01
35500	2.000E-01	2.005E-01	2.011E-01	2.021E-01	2.047E-01	2.097E-01	2.173E-01	2.263E-01	2.352E-01	2.440E-01
36000	2.020E-01	2.025E-01	2.031E-01	2.041E-01	2.067E-01	2.117E-01	2.193E-01	2.283E-01	2.372E-01	2.460E-01
36500	2.040E-01	2.045E-01	2.051E-01	2.061E-01	2.087E-01	2.137E-01	2.213E-01	2.303E-01	2.392E-01	2.480E-01
37000	2.060E-01	2.065E-01	2.071E-01	2.081E-01	2.107E-01	2.157E-01	2.233E-01	2.323E-01	2.412E-01	2.500E-01
37500	2.080E-01	2.085E-01	2.091E-01	2.101E-01	2.127E-01	2.177E-01	2.253E-01	2.343E-01	2.432E-01	2.520E-01
38000	2.100E-01	2.105E-01	2.111E-01	2.121E-01	2.147E-01	2.197E-01	2.273E-01	2.363E-01	2.452E-01	2.540E-01
38500	2.120E-01	2.125E-01	2.131E-01	2.141E-01	2.167E-01	2.217E-01	2.293E-01	2.383E-01	2.472E-01	2.560E-01
39000	2.140E-01	2.145E-01	2.151E-01	2.161E-01	2.187E-01	2.237E-01	2.313E-01	2.403E-01	2.492E-01	2.580E-01
39500	2.160E-01	2.165E-01	2.171E-01	2.181E-01	2.207E-01	2.257E-01	2.333E-01	2.423E-01	2.512E-01	2.600E-01
40000	2.180E-01	2.185E-01	2.191E-01	2.201E-01	2.227E-01	2.277E-01	2.353E-01	2.443E-01	2.532E-01	2.620E-01
40500	2.200E-01	2.205E-01	2.211E-01	2.221E-01	2.247E-01	2.297E-01	2.373E-01	2.463E-01	2.552E-01	2.640E-01
41000	2.220E-01	2.225E-01	2.231E-01	2.241E-01	2.267E-01	2.317E-01	2.393E-01	2.483E-01	2.572E-01	2.660E-01
41500	2.240E-01	2.245E-01	2.251E-01	2.261E-01	2.287E-01	2.337E-01	2.413E-01	2.503E-01	2.592E-01	2.680E-01
42000	2.260E-01	2.265E-01	2.271E-01	2.281E-01	2.307E-01	2.357E-01	2.433E-01	2.523E-01	2.612E-01	2.700E-01
42500	2.280E-01	2.285E-01	2.291E-01	2.301E-01	2.327E-01	2.377E-01	2.453E-01	2.543E-01	2.632E-01	2.720E-01
43000	2.300E-01	2.305E-01	2.311E-01	2.321E-01	2.347E-01	2.397E-01	2.473E-01	2.563E-01	2.652E-01	2.740E-01
43500	2.320E-01	2.325E-01	2.331E-01	2.341E-01	2.367E-01	2.417E-01	2.493E-01	2.583E-01	2.672E-01	2.760E-01
44000	2.340E-01	2.345E-01	2.351E-01	2.361E-01	2.387E-01	2.437E-01	2.513E-01	2.603E-01	2.692E-01	2.780E-01
44500	2.360E-01	2.365E-01	2.371E-01	2.381E-01	2.407E-01	2.457E-01	2.533E-01	2.623E-01	2.712E-01	2.800E-01
45000	2.380E-01	2.385E-01	2.391E-01	2.401E-01	2.427E-01	2.477E-01	2.553E-01	2.643E-01	2.732E-01	2.820E-01
45500	2.400E-01	2.405E-01	2.411E-01	2.421E-01	2.447E-01	2.497E-01	2.573E-01	2.663E-01	2.752E-01	2.840E-01
46000	2.420E-01	2.425E-01	2.431E-01	2.441E-01	2.467E-01	2.517E-01	2.593E-01	2.683E-01	2.772E-01	2.860E-01
46500	2.440E-01	2.445E-01	2.451E-01	2.461E-01	2.487E-01	2.537E-01	2.613E-01	2.703E-01	2.792E-01	2.880E-01
47000	2.460E-01	2.465E-01	2.471E-01	2.481E-01	2.507E-01	2.557E-01	2.633E-01	2.723E-01	2.812E-01	2.900E-01
47500	2.480E-01	2.485E-01	2.491E-01	2.501E-01	2.527E-01	2.577E-01	2.653E-01	2.743E-01	2.832E-01	2.920E-01
48000	2.500E-01	2.505E-01	2.511E-01	2.521E-01	2.547E-01	2.597E-01	2.673E-01	2.763E-01	2.852E-01	2.940E-01
48500	2.520E-01	2.525E-01	2.531E-01	2.541E-01	2.567E-01	2.617E-01	2.693E-01	2.783E-01	2.872E-01	2.960E-01
49000	2.540E-01	2.545E-01	2.551E-01	2.561E-01	2.587E-01	2.637E-01	2.713E-01			

9CC00	1.434E-01	1.509E-01	1.588E-01	1.649E-01	1.764E-01	1.864E-01	1.955E-01	2.037E-01	2.101E-01	2.114E-01
10C000	1.482E-01	1.534E-01	1.610E-01	1.693E-01	1.779E-01	1.874E-01	1.972E-01	2.058E-01	2.121E-01	2.136E-01
15C000	1.679E-01	1.805E-01	1.901E-01	1.928E-01	1.947E-01	2.023E-01	2.099E-01	2.182E-01	2.252E-01	2.279E-01
20C000	2.247E-01	2.284E-01	2.284E-01	2.287E-01	2.293E-01	2.311E-01	2.344E-01	2.391E-01	2.440E-01	2.485E-01
30C000	2.901E-01	2.917E-01	2.924E-01	2.926E-01	2.924E-01	2.925E-01	2.927E-01	2.934E-01	2.959E-01	2.993E-01
4CC000	2.358E-01	2.635E-01	2.969E-01	3.214E-01	3.332E-01	3.380E-01	3.401E-01	3.415E-01	3.433E-01	3.465E-01
5C0C00	2.004E-01	2.214E-01	2.434E-01	2.635E-01	2.950E-01	3.298E-01	3.562E-01	3.783E-01	3.775E-01	3.829E-01
6C0C00	1.991E-01	2.057E-01	2.170E-01	2.346E-01	2.615E-01	2.875E-01	3.184E-01	3.539E-01	3.830E-01	4.012E-01
8C0C00	2.295E-01	2.302E-01	2.321E-01	2.343E-01	2.435E-01	2.550E-01	2.743E-01	3.014E-01	3.325E-01	3.673E-01
1CC0000	2.639E-01	2.639E-01	2.640E-01	2.644E-01	2.657E-01	2.691E-01	2.760E-01	2.881E-01	3.076E-01	3.352E-01
15C0C00	3.304E-01	3.304E-01	3.304E-01	3.304E-01	3.305E-01	3.304E-01	3.309E-01	3.319E-01	3.347E-01	3.413E-01
2CC0C00	3.761E-01	3.761E-01	3.761E-01	3.761E-01	3.762E-01	3.762E-01	3.764E-01	3.787E-01	3.795E-01	3.813E-01
30C0000	4.388E-01	4.393E-01	4.400E-01	4.407E-01	4.414E-01	4.418E-01	4.421E-01	4.425E-01	4.431E-01	4.441E-01
4C00C00	4.794E-01	4.794E-01	4.795E-01	4.796E-01	4.798E-01	4.804E-01	4.812E-01	4.822E-01	4.832E-01	4.844E-01
5C00C00	5.079E-01	5.079E-01	5.080E-01	5.080E-01	5.081E-01	5.082E-01	5.084E-01	5.090E-01	5.100E-01	5.114E-01
6C0C000	5.284E-01	5.289E-01	5.290E-01	5.290E-01	5.290E-01	5.291E-01	5.292E-01	5.295E-01	5.301E-01	5.311E-01
8C0C0C0	5.577E-01	5.577E-01	5.577E-01	5.578E-01	5.578E-01	5.579E-01	5.580E-01	5.581E-01	5.585E-01	5.590E-01
1CC0C0C0	5.766E-01	5.766E-01	5.766E-01	5.766E-01	5.766E-01	5.767E-01	5.768E-01	5.769E-01	5.772E-01	5.776E-01

TABLE 110. DIMENSIONLESS ENTROPY, S/R, OF EQUILIBRIUM AIR

TEMP. (DEG K)	-9.0	-8.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.5	-5.0	-4.5	-4.0
10500	1.453E 02	1.397E 02	1.351E 02	1.304E 02	1.258E 02	1.201E 02	1.134E 02	1.045E 02	9.417E 01	8.427E 01	7.410E 01
10500	1.446E 02	1.400E 02	1.354E 02	1.306E 02	1.258E 02	1.212E 02	1.156E 02	1.085E 02	9.932E 01	8.921E 01	7.890E 01
10500	1.450E 02	1.404E 02	1.358E 02	1.312E 02	1.265E 02	1.218E 02	1.167E 02	1.108E 02	1.032E 02	9.300E 01	8.409E 01
11500	1.456E 02	1.408E 02	1.361E 02	1.315E 02	1.269E 02	1.222E 02	1.174E 02	1.121E 02	1.037E 02	9.755E 01	8.808E 01
12500	1.459E 02	1.414E 02	1.365E 02	1.318E 02	1.272E 02	1.226E 02	1.179E 02	1.129E 02	1.039E 02	1.003E 02	9.162E 01
12500	1.456E 02	1.426E 02	1.371E 02	1.322E 02	1.275E 02	1.229E 02	1.182E 02	1.134E 02	1.039E 02	1.022E 02	9.449E 01
13500	1.548E 02	1.450E 02	1.382E 02	1.327E 02	1.279E 02	1.232E 02	1.185E 02	1.138E 02	1.039E 02	1.034E 02	9.644E 01
13500	1.628E 02	1.495E 02	1.402E 02	1.337E 02	1.284E 02	1.235E 02	1.189E 02	1.142E 02	1.042E 02	1.042E 02	9.819E 01
14500	1.718E 02	1.563E 02	1.439E 02	1.353E 02	1.291E 02	1.240E 02	1.192E 02	1.145E 02	1.039E 02	1.040E 02	9.927E 01
14500	1.797E 02	1.642E 02	1.495E 02	1.382E 02	1.304E 02	1.246E 02	1.196E 02	1.148E 02	1.039E 02	1.053E 02	1.000E 02
15500	1.859E 02	1.718E 02	1.563E 02	1.426E 02	1.328E 02	1.256E 02	1.200E 02	1.151E 02	1.042E 02	1.056E 02	1.006E 02
15500	1.908E 02	1.779E 02	1.633E 02	1.483E 02	1.359E 02	1.271E 02	1.208E 02	1.155E 02	1.042E 02	1.060E 02	1.011E 02
16500	1.945E 02	1.828E 02	1.684E 02	1.546E 02	1.404E 02	1.295E 02	1.219E 02	1.161E 02	1.042E 02	1.063E 02	1.014E 02
16500	1.972E 02	1.867E 02	1.744E 02	1.605E 02	1.457E 02	1.329E 02	1.235E 02	1.168E 02	1.042E 02	1.066E 02	1.018E 02
17500	1.989E 02	1.894E 02	1.755E 02	1.656E 02	1.512E 02	1.371E 02	1.259E 02	1.179E 02	1.042E 02	1.069E 02	1.021E 02
17500	1.999E 02	1.916E 02	1.817E 02	1.698E 02	1.562E 02	1.418E 02	1.290E 02	1.195E 02	1.042E 02	1.073E 02	1.024E 02
18500	2.066E 02	1.929E 02	1.840E 02	1.733E 02	1.606E 02	1.465E 02	1.327E 02	1.217E 02	1.042E 02	1.078E 02	1.027E 02
18500	2.012E 02	1.937E 02	1.856E 02	1.759E 02	1.643E 02	1.509E 02	1.368E 02	1.244E 02	1.042E 02	1.085E 02	1.031E 02
19500	2.017E 02	1.944E 02	1.867E 02	1.779E 02	1.673E 02	1.540E 02	1.409E 02	1.276E 02	1.042E 02	1.093E 02	1.035E 02
19500	2.024E 02	1.949E 02	1.874E 02	1.793E 02	1.697E 02	1.561E 02	1.430E 02	1.310E 02	1.042E 02	1.105E 02	1.041E 02
20500	2.032E 02	1.955E 02	1.880E 02	1.803E 02	1.715E 02	1.609E 02	1.483E 02	1.346E 02	1.042E 02	1.120E 02	1.048E 02
22500	2.140E 02	2.005E 02	1.908E 02	1.827E 02	1.751E 02	1.671E 02	1.579E 02	1.466E 02	1.042E 02	1.207E 02	1.098E 02
24500	2.358E 02	2.170E 02	1.999E 02	1.871E 02	1.777E 02	1.694E 02	1.618E 02	1.532E 02	1.042E 02	1.304E 02	1.179E 02
26500	2.503E 02	2.350E 02	2.174E 02	1.993E 02	1.841E 02	1.729E 02	1.641E 02	1.561E 02	1.042E 02	1.377E 02	1.260E 02
28500	2.562E 02	2.448E 02	2.310E 02	2.148E 02	1.969E 02	1.806E 02	1.680E 02	1.585E 02	1.042E 02	1.417E 02	1.319E 02
30500	2.595E 02	2.488E 02	2.379E 02	2.252E 02	2.039E 02	1.826E 02	1.700E 02	1.627E 02	1.042E 02	1.441E 02	1.355E 02
32500	2.659E 02	2.524E 02	2.412E 02	2.304E 02	2.101E 02	1.877E 02	1.807E 02	1.702E 02	1.042E 02	1.465E 02	1.378E 02
34500	2.811E 02	2.608E 02	2.455E 02	2.336E 02	2.255E 02	2.104E 02	1.960E 02	1.795E 02	1.042E 02	1.503E 02	1.401E 02
36500	2.981E 02	2.759E 02	2.548E 02	2.384E 02	2.257E 02	2.143E 02	2.021E 02	1.877E 02	1.042E 02	1.559E 02	1.433E 02
38500	3.051E 02	2.902E 02	2.687E 02	2.477E 02	2.306E 02	2.175E 02	2.059E 02	1.934E 02	1.042E 02	1.627E 02	1.479E 02
40500	3.154E 02	2.994E 02	2.810E 02	2.600E 02	2.393E 02	2.223E 02	2.090E 02	1.971E 02	1.042E 02	1.692E 02	1.535E 02
42500	3.218E 02	3.052E 02	2.891E 02	2.708E 02	2.502E 02	2.299E 02	2.133E 02	2.002E 02	1.042E 02	1.745E 02	1.593E 02
44500	3.320E 02	3.115E 02	2.946E 02	2.783E 02	2.599E 02	2.394E 02	2.198E 02	2.039E 02	1.042E 02	1.784E 02	1.643E 02
46500	3.447E 02	3.209E 02	3.005E 02	2.836E 02	2.669E 02	2.482E 02	2.279E 02	2.093E 02	1.042E 02	1.815E 02	1.684E 02
48500	3.533E 02	3.322E 02	3.089E 02	2.890E 02	2.721E 02	2.550E 02	2.360E 02	2.161E 02	1.042E 02	1.844E 02	1.715E 02
50500	3.629E 02	3.420E 02	3.169E 02	2.962E 02	2.770E 02	2.601E 02	2.426E 02	2.232E 02	1.042E 02	1.878E 02	1.743E 02
52500	3.774E 02	3.617E 02	3.462E 02	3.296E 02	3.108E 02	2.894E 02	2.672E 02	2.495E 02	1.042E 02	2.117E 02	1.931E 02
70500	3.884E 02	3.729E 02	3.564E 02	3.395E 02	3.234E 02	3.076E 02	2.905E 02	2.711E 02	1.042E 02	2.498E 02	2.107E 02
80500	3.916E 02	3.772E 02	3.627E 02	3.478E 02	3.321E 02	3.156E 02	2.991E 02	2.830E 02	1.042E 02	2.470E 02	2.263E 02

9CC00	3.930E 02	3.795E 02	3.612E 02	3.509E 02	3.344E 02	3.214E 02	3.041E 02	2.897E 02	2.739E 02	2.569E 02	2.393E 02
100000	3.957E 02	3.815E 02	3.672E 02	3.529E 02	3.364E 02	3.243E 02	3.097E 02	2.940E 02	2.790E 02	2.627E 02	2.462E 02
150000	4.033E 02	3.890E 02	3.747E 02	3.605E 02	3.427E 02	3.319E 02	3.177E 02	3.034E 02	2.891E 02	2.740E 02	2.605E 02
200000	4.111E 02	3.954E 02	3.806E 02	3.661E 02	3.510E 02	3.394E 02	3.231E 02	3.088E 02	2.945E 02	2.802E 02	2.659E 02
300000	5.133E 02	4.843E 02	4.531E 02	4.232E 02	4.024E 02	3.817E 02	3.592E 02	3.345E 02	3.100E 02	2.913E 02	2.740E 02
400000	5.423E 02	5.222E 02	5.009E 02	4.789E 02	4.579E 02	4.344E 02	4.134E 02	3.871E 02	3.595E 02	3.323E 02	3.097E 02

500000	5.485E 02	5.290E 02	5.104E 02	4.917E 02	4.726E 02	4.531E 02	4.340E 02	4.117E 02	3.901E 02	3.685E 02	3.454E 02
600000	5.530E 02	5.341E 02	5.152E 02	4.963E 02	4.773E 02	4.584E 02	4.394E 02	4.204E 02	4.011E 02	3.812E 02	3.604E 02
800000	5.601E 02	5.412E 02	5.223E 02	5.033E 02	4.844E 02	4.655E 02	4.466E 02	4.277E 02	4.087E 02	3.898E 02	3.709E 02
1000000	5.656E 02	5.467E 02	5.278E 02	5.088E 02	4.899E 02	4.710E 02	4.521E 02	4.332E 02	4.143E 02	3.953E 02	3.764E 02
1500000	5.757E 02	5.567E 02	5.378E 02	5.188E 02	4.999E 02	4.810E 02	4.621E 02	4.432E 02	4.242E 02	4.053E 02	3.864E 02
2000000	5.833E 02	5.643E 02	5.454E 02	5.264E 02	5.074E 02	4.884E 02	4.694E 02	4.504E 02	4.314E 02	4.124E 02	3.934E 02
3000000	5.933E 02	5.744E 02	5.554E 02	5.365E 02	5.175E 02	4.986E 02	4.797E 02	4.607E 02	4.418E 02	4.228E 02	4.039E 02
4000000	6.004E 02	5.815E 02	5.625E 02	5.436E 02	5.246E 02	5.057E 02	4.868E 02	4.679E 02	4.490E 02	4.299E 02	4.110E 02
5000000	6.099E 02	5.870E 02	5.680E 02	5.491E 02	5.301E 02	5.112E 02	4.923E 02	4.733E 02	4.544E 02	4.354E 02	4.165E 02
6000000	6.164E 02	5.915E 02	5.725E 02	5.534E 02	5.344E 02	5.154E 02	4.964E 02	4.774E 02	4.584E 02	4.394E 02	4.210E 02
8000000	6.175E 02	5.906E 02	5.704E 02	5.607E 02	5.417E 02	5.228E 02	5.038E 02	4.848E 02	4.660E 02	4.470E 02	4.281E 02
10000000	6.230E 02	6.041E 02	5.851E 02	5.662E 02	5.472E 02	5.283E 02	5.094E 02	4.904E 02	4.715E 02	4.525E 02	4.336E 02

TABLE 110(CONT) DIMENSIONLESS ENTROPY, S/R, OF EQUILIBRIUM AIR

TEMP. (DEG K)	-3.5	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0
1000	7.001E 01	6.531E 01	6.157E 01	5.842E 01	5.554E 01	5.288E 01	4.951E 01	4.587E 01	4.200E 01	3.804E 01
1050	7.264E 01	6.703E 01	6.271E 01	5.920E 01	5.615E 01	5.328E 01	5.030E 01	4.692E 01	4.320E 01	3.942E 01
1100	7.563E 01	6.910E 01	6.407E 01	6.011E 01	5.681E 01	5.385E 01	5.094E 01	4.777E 01	4.420E 01	4.037E 01
1150	7.898E 01	7.147E 01	6.566E 01	6.117E 01	5.754E 01	5.442E 01	5.150E 01	4.847E 01	4.500E 01	4.147E 01
1200	8.234E 01	7.407E 01	6.747E 01	6.238E 01	5.837E 01	5.502E 01	5.202E 01	4.905E 01	4.583E 01	4.231E 01
1250	8.553E 01	7.680E 01	6.947E 01	6.375E 01	5.929E 01	5.568E 01	5.254E 01	4.957E 01	4.647E 01	4.304E 01
1300	8.834E 01	7.951E 01	7.161E 01	6.524E 01	6.033E 01	5.639E 01	5.308E 01	5.004E 01	4.703E 01	4.373E 01
1350	9.067E 01	8.208E 01	7.381E 01	6.689E 01	6.144E 01	5.717E 01	5.365E 01	5.034E 01	4.752E 01	4.433E 01
1400	9.250E 01	8.439E 01	7.599E 01	6.860E 01	6.268E 01	5.802E 01	5.426E 01	5.102E 01	4.799E 01	4.487E 01
1450	9.388E 01	8.637E 01	7.808E 01	7.036E 01	6.397E 01	5.893E 01	5.490E 01	5.131E 01	4.843E 01	4.535E 01
1500	9.492E 01	8.800E 01	8.001E 01	7.210E 01	6.532E 01	5.990E 01	5.559E 01	5.202E 01	4.880E 01	4.580E 01
1550	9.569E 01	8.930E 01	8.173E 01	7.360E 01	6.670E 01	6.091E 01	5.631E 01	5.254E 01	4.930E 01	4.622E 01
1600	9.628E 01	9.033E 01	8.321E 01	7.541E 01	6.800E 01	6.196E 01	5.707E 01	5.312E 01	4.974E 01	4.663E 01
1650	9.676E 01	9.114E 01	8.447E 01	7.689E 01	6.945E 01	6.304E 01	5.787E 01	5.370E 01	5.019E 01	4.703E 01
1700	9.715E 01	9.178E 01	8.551E 01	7.823E 01	7.077E 01	6.412E 01	5.868E 01	5.430E 01	5.066E 01	4.743E 01
1750	9.749E 01	9.230E 01	8.636E 01	7.942E 01	7.202E 01	6.520E 01	5.951E 01	5.492E 01	5.113E 01	4.783E 01
1800	9.780E 01	9.273E 01	8.707E 01	8.045E 01	7.319E 01	6.627E 01	6.036E 01	5.555E 01	5.142E 01	4.823E 01
1850	9.810E 01	9.310E 01	8.765E 01	8.134E 01	7.428E 01	6.730E 01	6.120E 01	5.620E 01	5.211E 01	4.883E 01
1900	9.842E 01	9.344E 01	8.814E 01	8.211E 01	7.524E 01	6.829E 01	6.204E 01	5.686E 01	5.262E 01	4.905E 01
1950	9.875E 01	9.375E 01	8.857E 01	8.276E 01	7.614E 01	6.923E 01	6.287E 01	5.752E 01	5.313E 01	4.948E 01
2000	9.914E 01	9.405E 01	8.894E 01	8.332E 01	7.693E 01	7.011E 01	6.368E 01	5.817E 01	5.365E 01	4.991E 01
2200	1.017E 02	9.553E 01	9.021E 01	8.487E 01	7.930E 01	7.303E 01	6.641E 01	6.072E 01	5.571E 01	5.167E 01
2400	1.067E 02	9.818E 01	9.173E 01	8.634E 01	8.085E 01	7.508E 01	6.896E 01	6.298E 01	5.771E 01	5.339E 01
2600	1.136E 02	1.027E 02	9.421E 01	8.771E 01	8.210E 01	7.657E 01	7.077E 01	6.499E 01	5.951E 01	5.498E 01
2800	1.204E 02	1.085E 02	9.801E 01	8.987E 01	8.348E 01	7.781E 01	7.218E 01	6.646E 01	6.107E 01	5.640E 01
3000	1.255E 02	1.141E 02	1.027E 02	9.292E 01	8.529E 01	7.909E 01	7.340E 01	6.778E 01	6.237E 01	5.765E 01
3200	1.289E 02	1.187E 02	1.074E 02	9.664E 01	8.767E 01	8.059E 01	7.459E 01	6.894E 01	6.357E 01	5.875E 01
3400	1.313E 02	1.220E 02	1.116E 02	1.005E 02	9.055E 01	8.245E 01	7.588E 01	7.003E 01	6.462E 01	5.974E 01
3600	1.334E 02	1.244E 02	1.148E 02	1.042E 02	9.367E 01	8.465E 01	7.735E 01	7.119E 01	6.563E 01	6.066E 01
3800	1.361E 02	1.265E 02	1.172E 02	1.072E 02	9.674E 01	8.707E 01	7.903E 01	7.241E 01	6.662E 01	6.153E 01
4000	1.397E 02	1.287E 02	1.193E 02	1.097E 02	9.953E 01	8.956E 01	8.089E 01	7.374E 01	6.765E 01	6.239E 01
4200	1.442E 02	1.315E 02	1.212E 02	1.118E 02	1.019E 02	9.196E 01	8.284E 01	7.517E 01	6.873E 01	6.326E 01
4400	1.491E 02	1.350E 02	1.234E 02	1.136E 02	1.040E 02	9.417E 01	8.479E 01	7.688E 01	6.985E 01	6.414E 01
4600	1.537E 02	1.389E 02	1.261E 02	1.155E 02	1.058E 02	9.616E 01	8.668E 01	7.822E 01	7.102E 01	6.504E 01
4800	1.578E 02	1.430E 02	1.291E 02	1.175E 02	1.075E 02	9.794E 01	8.846E 01	7.975E 01	7.222E 01	6.594E 01
5000	1.611E 02	1.468E 02	1.324E 02	1.198E 02	1.092E 02	9.956E 01	9.011E 01	8.124E 01	7.343E 01	6.690E 01
6000	1.755E 02	1.604E 02	1.468E 02	1.330E 02	1.174E 02	9.710E 01	8.774E 01	7.912E 01	7.153E 01	6.912E 01
7000	1.931E 02	1.751E 02	1.582E 02	1.433E 02	1.296E 02	1.163E 02	1.041E 02	9.348E 01	8.412E 01	7.581E 01
8000	2.065E 02	1.884E 02	1.708E 02	1.536E 02	1.381E 02	1.241E 02	1.112E 02	9.932E 01	8.893E 01	7.989E 01

100000	2.291E 02	2.104E 02	1.908E 02	1.697E 02	1.488E 02	1.313E 02	1.174E 02	1.048E 02	9.341E 01	8.388E 01
120000	2.389E 02	2.225E 02	2.054E 02	1.872E 02	1.685E 02	1.508E 02	1.344E 02	1.193E 02	1.039E 02	9.422E 01
150000	2.468E 02	2.312E 02	2.157E 02	1.995E 02	1.827E 02	1.652E 02	1.477E 02	1.312E 02	1.142E 02	1.029E 02
200000	2.516E 02	2.373E 02	2.229E 02	2.083E 02	1.933E 02	1.777E 02	1.615E 02	1.450E 02	1.289E 02	1.140E 02
250000	2.559E 02	2.415E 02	2.272E 02	2.128E 02	1.983E 02	1.834E 02	1.685E 02	1.528E 02	1.370E 02	1.216E 02
300000	2.597E 02	2.451E 02	2.307E 02	2.163E 02	2.019E 02	1.874E 02	1.727E 02	1.577E 02	1.423E 02	1.268E 02
350000	2.630E 02	2.504E 02	2.345E 02	2.196E 02	2.050E 02	1.905E 02	1.759E 02	1.611E 02	1.461E 02	1.309E 02
400000	2.677E 02	2.647E 02	2.429E 02	2.245E 02	2.084E 02	1.934E 02	1.787E 02	1.639E 02	1.491E 02	1.341E 02
450000	3.020E 02	2.793E 02	2.571E 02	2.348E 02	2.145E 02	1.971E 02	1.815E 02	1.645E 02	1.517E 02	1.367E 02
500000	3.194E 02	2.929E 02	2.687E 02	2.465E 02	2.244E 02	2.034E 02	1.874E 02	1.673E 02	1.541E 02	1.391E 02
600000	3.389E 02	3.168E 02	2.931E 02	2.676E 02	2.478E 02	2.201E 02	1.995E 02	1.782E 02	1.641E 02	1.439E 02
700000	3.477E 02	3.273E 02	3.059E 02	2.839E 02	2.604E 02	2.356E 02	2.110E 02	1.898E 02	1.691E 02	1.501E 02
800000	3.510E 02	3.326E 02	3.129E 02	2.924E 02	2.708E 02	2.483E 02	2.245E 02	2.007E 02	1.785E 02	1.578E 02
900000	3.549E 02	3.359E 02	3.168E 02	2.973E 02	2.772E 02	2.560E 02	2.339E 02	2.104E 02	1.873E 02	1.634E 02
1000000	3.575E 02	3.385E 02	3.194E 02	3.005E 02	2.811E 02	2.611E 02	2.401E 02	2.181E 02	1.952E 02	1.725E 02
1200000	3.620E 02	3.431E 02	3.241E 02	3.052E 02	2.862E 02	2.670E 02	2.475E 02	2.273E 02	2.041E 02	1.841E 02
1500000	3.675E 02	3.486E 02	3.294E 02	3.107E 02	2.918E 02	2.728E 02	2.537E 02	2.343E 02	2.149E 02	1.944E 02
2000000	3.748E 02	3.557E 02	3.367E 02	3.178E 02	2.989E 02	2.799E 02	2.610E 02	2.420E 02	2.229E 02	2.034E 02
2500000	3.802E 02	3.612E 02	3.423E 02	3.233E 02	3.044E 02	2.855E 02	2.665E 02	2.475E 02	2.285E 02	2.094E 02
3000000	3.849E 02	3.659E 02	3.469E 02	3.279E 02	3.090E 02	2.900E 02	2.710E 02	2.521E 02	2.331E 02	2.140E 02
3500000	3.888E 02	3.698E 02	3.509E 02	3.319E 02	3.129E 02	2.939E 02	2.749E 02	2.559E 02	2.369E 02	2.179E 02
4000000	3.921E 02	3.731E 02	3.542E 02	3.352E 02	3.163E 02	2.973E 02	2.783E 02	2.593E 02	2.403E 02	2.212E 02
4500000	3.950E 02	3.760E 02	3.571E 02	3.381E 02	3.192E 02	3.002E 02	2.813E 02	2.623E 02	2.432E 02	2.242E 02
5000000	3.976E 02	3.786E 02	3.597E 02	3.407E 02	3.218E 02	3.028E 02	2.839E 02	2.649E 02	2.459E 02	2.269E 02
6000000	4.021E 02	3.831E 02	3.642E 02	3.452E 02	3.263E 02	3.074E 02	2.884E 02	2.694E 02	2.504E 02	2.315E 02
7000000	4.059E 02	3.869E 02	3.680E 02	3.490E 02	3.301E 02	3.112E 02	2.922E 02	2.732E 02	2.542E 02	2.353E 02
8000000	4.092E 02	3.902E 02	3.713E 02	3.523E 02	3.334E 02	3.145E 02	2.955E 02	2.765E 02	2.575E 02	2.384E 02
9000000	4.121E 02	3.931E 02	3.747E 02	3.552E 02	3.363E 02	3.174E 02	2.984E 02	2.794E 02	2.604E 02	2.414E 02
10000000	4.147E 02	3.951E 02	3.768E 02	3.578E 02	3.389E 02	3.200E 02	3.010E 02	2.821E 02	2.631E 02	2.447E 02

TABLE 111. ENTROPY (ERG/CM-DEG K) OF EQUILIBRIUM AIR

TEMP. (DEG K)	-9.0	-8.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.5	-5.0	-4.5	-4.0
1000	4.141E 08	4.009E 08	3.877E 08	3.743E 08	3.603E 08	3.448E 08	3.284E 08	3.000E 08	2.703E 08	2.419E 08	2.187E 08
1050	4.152E 08	4.019E 08	3.887E 08	3.753E 08	3.620E 08	3.478E 08	3.317E 08	3.113E 08	2.851E 08	2.561E 08	2.294E 08
1100	4.163E 08	4.029E 08	3.897E 08	3.763E 08	3.632E 08	3.495E 08	3.350E 08	3.100E 08	2.928E 08	2.692E 08	2.414E 08
1150	4.180E 08	4.041E 08	3.907E 08	3.774E 08	3.642E 08	3.508E 08	3.369E 08	3.210E 08	3.035E 08	2.800E 08	2.528E 08
1200	4.215E 08	4.086E 08	3.910E 08	3.784E 08	3.651E 08	3.518E 08	3.383E 08	3.241E 08	3.060E 08	2.879E 08	2.630E 08
1250	4.259E 08	4.092E 08	3.935E 08	3.795E 08	3.660E 08	3.527E 08	3.392E 08	3.256E 08	3.108E 08	2.933E 08	2.712E 08
1300	4.444E 08	4.162E 08	3.965E 08	3.810E 08	3.671E 08	3.536E 08	3.403E 08	3.268E 08	3.120E 08	2.968E 08	2.774E 08
1350	4.673E 08	4.291E 08	4.025E 08	3.834E 08	3.684E 08	3.548E 08	3.412E 08	3.277E 08	3.140E 08	2.992E 08	2.818E 08
1400	4.931E 08	4.480E 08	4.131E 08	3.888E 08	3.706E 08	3.558E 08	3.421E 08	3.286E 08	3.151E 08	3.009E 08	2.849E 08
1450	5.159E 08	4.714E 08	4.291E 08	3.967E 08	3.743E 08	3.574E 08	3.431E 08	3.295E 08	3.160E 08	3.022E 08	2.872E 08
1500	5.336E 08	4.930E 08	4.488E 08	4.094E 08	3.806E 08	3.604E 08	3.444E 08	3.305E 08	3.189E 08	3.032E 08	2.880E 08
1550	5.475E 08	5.107E 08	4.687E 08	4.258E 08	3.902E 08	3.649E 08	3.466E 08	3.316E 08	3.178E 08	3.041E 08	2.901E 08
1600	5.584E 08	5.247E 08	4.843E 08	4.434E 08	4.031E 08	3.718E 08	3.498E 08	3.332E 08	3.187E 08	3.050E 08	2.911E 08
1650	5.660E 08	5.359E 08	5.007E 08	4.608E 08	4.183E 08	3.815E 08	3.544E 08	3.353E 08	3.199E 08	3.059E 08	2.921E 08
1700	5.708E 08	5.443E 08	5.123E 08	4.732E 08	4.339E 08	3.935E 08	3.614E 08	3.385E 08	3.219E 08	3.040E 08	2.930E 08
1750	5.738E 08	5.499E 08	5.214E 08	4.874E 08	4.504E 08	4.070E 08	3.703E 08	3.431E 08	3.256E 08	3.080E 08	2.930E 08
1800	5.774E 08	5.530E 08	5.227E 08	4.905E 08	4.516E 08	4.205E 08	3.810E 08	3.493E 08	3.285E 08	3.094E 08	2.940E 08
1850	5.774E 08	5.530E 08	5.227E 08	4.905E 08	4.516E 08	4.205E 08	3.810E 08	3.493E 08	3.285E 08	3.094E 08	2.940E 08
1900	5.790E 08	5.548E 08	5.350E 08	5.107E 08	4.803E 08	4.443E 08	4.044E 08	3.662E 08	3.358E 08	3.139E 08	2.971E 08
1950	5.808E 08	5.564E 08	5.380E 08	5.147E 08	4.872E 08	4.539E 08	4.154E 08	3.761E 08	3.422E 08	3.172E 08	2.987E 08
2000	5.834E 08	5.610E 08	5.397E 08	5.173E 08	4.923E 08	4.618E 08	4.237E 08	3.863E 08	3.498E 08	3.214E 08	3.008E 08
2200	6.141E 08	5.716E 08	5.476E 08	5.245E 08	5.027E 08	4.797E 08	4.531E 08	4.208E 08	3.837E 08	3.465E 08	3.151E 08
2400	6.768E 08	6.220E 08	5.738E 08	5.371E 08	5.100E 08	4.849E 08	4.644E 08	4.394E 08	4.098E 08	3.748E 08	3.363E 08
2600	7.183E 08	6.745E 08	6.240E 08	5.720E 08	5.283E 08	4.962E 08	4.710E 08	4.481E 08	4.238E 08	3.953E 08	3.616E 08
2800	7.334E 08	7.025E 08	6.631E 08	6.164E 08	5.653E 08	5.183E 08	4.822E 08	4.549E 08	4.312E 08	4.040E 08	3.766E 08
3000	7.444E 08	7.142E 08	6.828E 08	6.463E 08	6.025E 08	5.529E 08	5.051E 08	4.670E 08	4.382E 08	4.137E 08	3.880E 08
3200	7.633E 08	7.244E 08	6.925E 08	6.617E 08	6.261E 08	5.839E 08	5.459E 08	5.066E 08	4.700E 08	4.206E 08	3.954E 08
3400	8.049E 08	7.486E 08	7.047E 08	6.704E 08	6.384E 08	6.038E 08	5.625E 08	5.153E 08	4.691E 08	4.313E 08	4.022E 08
3600	8.557E 08	7.919E 08	7.315E 08	6.841E 08	6.478E 08	6.152E 08	5.801E 08	5.387E 08	4.921E 08	4.475E 08	4.113E 08
3800	8.872E 08	8.331E 08	7.714E 08	7.103E 08	6.620E 08	6.244E 08	5.909E 08	5.550E 08	5.130E 08	4.670E 08	4.245E 08
4000	9.054E 08	8.594E 08	8.066E 08	7.464E 08	6.938E 08	6.380E 08	6.000E 08	5.658E 08	5.286E 08	4.857E 08	4.407E 08
4200	9.237E 08	8.761E 08	8.299E 08	7.774E 08	7.181E 08	6.599E 08	6.123E 08	5.746E 08	5.396E 08	5.008E 08	4.572E 08
4400	9.530E 08	8.941E 08	8.457E 08	7.987E 08	7.459E 08	6.871E 08	6.309E 08	5.854E 08	5.483E 08	5.121E 08	4.716E 08
4600	9.894E 08	9.211E 08	8.626E 08	8.140E 08	7.661E 08	7.174E 08	6.543E 08	6.007E 08	5.576E 08	5.209E 08	4.832E 08
4800	1.020E 09	9.535E 08	8.865E 08	8.295E 08	7.810E 08	7.320E 08	6.772E 08	6.201E 08	5.699E 08	5.292E 08	4.924E 08
5000	1.042E 09	9.817E 08	9.153E 08	8.501E 08	7.951E 08	7.467E 08	6.963E 08	6.406E 08	5.886E 08	5.390E 08	5.003E 08
6000	1.083E 09	1.038E 09	9.938E 08	9.462E 08	8.919E 08	8.307E 08	7.693E 08	7.093E 08	6.506E 08	6.077E 08	5.542E 08
7000	1.115E 09	1.070E 09	1.023E 09	9.745E 08	9.283E 08	8.828E 08	8.339E 08	7.781E 08	7.170E 08	6.577E 08	6.049E 08
8000	1.124E 09	1.083E 09	1.041E 09	9.984E 08	9.533E 08	9.057E 08	8.585E 08	8.123E 08	7.637E 08	7.090E 08	6.496E 08

100000	1.1295	07	1.0722	07	1.0722	07	1.0135	07	9.7195	08	9.3075	08	8.8905	08	8.4615	08	8.0095	08	7.5395	08	7.0675	08
120000	1.1455	09	1.1035	09	1.0645	09	1.0235	09	9.8105	08	9.4085	08	8.9985	08	8.5875	08	8.1745	08	7.7535	08	7.3145	08
150000	1.1585	09	1.1175	09	1.0745	09	1.0355	09	9.9375	08	9.5275	08	9.1185	08	8.7085	08	8.2985	08	7.8885	08	7.4745	08
200000	1.1805	09	1.1355	09	1.0925	09	1.0515	09	1.0105	09	9.6845	08	9.2735	08	8.8625	08	8.4525	08	8.0425	08	7.6325	08
250000	1.3245	09	1.2645	09	1.2015	09	1.1255	09	1.0525	09	9.9265	08	9.4395	08	8.9015	08	8.5815	08	8.1665	08	7.7545	08
300000	1.4735	09	1.3905	09	1.3015	09	1.2205	09	1.1555	09	1.0955	09	1.0315	09	9.6005	08	9.2215	08	8.7405	08	8.2605	08
350000	1.5235	09	1.4625	09	1.4035	09	1.3395	09	1.2655	09	1.1815	09	1.0995	09	1.0295	09	9.6745	08	9.0335	08	8.3495	08
400000	1.5575	09	1.4995	09	1.4385	09	1.3755	09	1.3135	09	1.2535	09	1.1875	09	1.1115	09	1.0295	09	9.5385	08	8.8885	08
450000	1.5675	09	1.5125	09	1.4575	09	1.4015	09	1.3435	09	1.2815	09	1.2195	09	1.1585	09	1.0935	09	1.0205	09	9.4035	08
500000	1.5745	09	1.5205	09	1.4645	09	1.4115	09	1.3545	09	1.3015	09	1.2435	09	1.1825	09	1.1205	09	1.0585	09	9.9135	08
600000	1.5875	09	1.5335	09	1.4795	09	1.4245	09	1.3705	09	1.3165	09	1.2615	09	1.2075	09	1.1515	09	1.0945	09	1.0345	09
700000	1.5985	09	1.5445	09	1.4905	09	1.4355	09	1.3815	09	1.3275	09	1.2725	09	1.2185	09	1.1645	09	1.1095	09	1.0545	09
800000	1.6085	09	1.5535	09	1.4995	09	1.4455	09	1.3905	09	1.3345	09	1.2825	09	1.2285	09	1.1735	09	1.1195	09	1.0645	09
900000	1.6165	09	1.5625	09	1.5075	09	1.4535	09	1.3995	09	1.3445	09	1.2905	09	1.2365	09	1.1825	09	1.1275	09	1.0735	09
1000000	1.6235	09	1.5695	09	1.5155	09	1.4615	09	1.4065	09	1.3525	09	1.2985	09	1.2435	09	1.1895	09	1.1355	09	1.0805	09
1200000	1.6365	09	1.5825	09	1.5285	09	1.4735	09	1.4195	09	1.3655	09	1.3115	09	1.2565	09	1.2025	09	1.1485	09	1.0935	09
1500000	1.6525	09	1.5985	09	1.5445	09	1.4895	09	1.4355	09	1.3815	09	1.3265	09	1.2725	09	1.2185	09	1.1635	09	1.1095	09
2000000	1.6745	09	1.6205	09	1.5655	09	1.5115	09	1.4565	09	1.4025	09	1.3475	09	1.2935	09	1.2385	09	1.1845	09	1.1295	09
2500000	1.6905	09	1.6365	09	1.5815	09	1.5275	09	1.4735	09	1.4185	09	1.3645	09	1.3095	09	1.2555	09	1.2005	09	1.1465	09
3000000	1.7035	09	1.6495	09	1.5945	09	1.5405	09	1.4855	09	1.4315	09	1.3775	09	1.3225	09	1.2685	09	1.2145	09	1.1595	09
3500000	1.7145	09	1.6595	09	1.6055	09	1.5515	09	1.4965	09	1.4425	09	1.3885	09	1.3335	09	1.2795	09	1.2255	09	1.1705	09
4000000	1.7235	09	1.6695	09	1.6155	09	1.5605	09	1.5045	09	1.4515	09	1.3975	09	1.3435	09	1.2895	09	1.2345	09	1.1805	09
4500000	1.7325	09	1.6775	09	1.6235	09	1.5695	09	1.5145	09	1.4605	09	1.4055	09	1.3515	09	1.2975	09	1.2425	09	1.1885	09
5000000	1.7395	09	1.6855	09	1.6305	09	1.5765	09	1.5225	09	1.4675	09	1.4135	09	1.3595	09	1.3045	09	1.2505	09	1.1955	09
6000000	1.7525	09	1.6985	09	1.6435	09	1.5895	09	1.5355	09	1.4805	09	1.4265	09	1.3715	09	1.3175	09	1.2635	09	1.2085	09
7000000	1.7635	09	1.7095	09	1.6545	09	1.6005	09	1.5455	09	1.4915	09	1.4375	09	1.3825	09	1.3285	09	1.2745	09	1.2195	09
8000000	1.7725	09	1.7185	09	1.6645	09	1.6095	09	1.5555	09	1.5015	09	1.4465	09	1.3925	09	1.3375	09	1.2835	09	1.2295	09
9000000	1.7815	09	1.7265	09	1.6725	09	1.6185	09	1.5635	09	1.5095	09	1.4555	09	1.4005	09	1.3465	09	1.2915	09	1.2375	09
10000000	1.7885	09	1.7345	09	1.6795	09	1.6255	09	1.5715	09	1.5165	09	1.4625	09	1.4085	09	1.3535	09	1.2995	09	1.2455	09



TABLE 111(CONT) ENTROPY (ERG/CM-DEG K) OF EQUILIBRIUM AIR

TEMP. (DEG K)	-3.3	-3.0	-2.5	-2.0	-1.0	-0.5	0.0	0.5	1.0
10000	2.009E 08	1.674E 08	1.767E 08	1.61E 08	1.512E 08	1.421E 08	1.317E 08	1.208E 08	1.110E 08
10500	2.035E 08	1.924E 08	1.800E 08	1.651E 08	1.529E 08	1.444E 08	1.347E 08	1.240E 08	1.137E 08
11000	2.172E 08	1.983E 08	1.839E 08	1.651E 08	1.542E 08	1.462E 08	1.371E 08	1.264E 08	1.164E 08
11500	2.267E 08	2.051E 08	1.885E 08	1.652E 08	1.562E 08	1.478E 08	1.391E 08	1.294E 08	1.190E 08
12000	2.363E 08	2.120E 08	1.917E 08	1.700E 08	1.675E 08	1.493E 08	1.408E 08	1.315E 08	1.214E 08
12500	2.459E 08	2.204E 08	1.994E 08	1.830E 08	1.762E 08	1.598E 08	1.423E 08	1.334E 08	1.236E 08
13000	2.554E 08	2.282E 08	2.059E 08	1.873E 08	1.731E 08	1.524E 08	1.437E 08	1.350E 08	1.255E 08
13500	2.603E 08	2.356E 08	2.119E 08	1.920E 08	1.764E 08	1.540E 08	1.451E 08	1.364E 08	1.272E 08
14000	2.659E 08	2.422E 08	2.181E 08	1.969E 08	1.799E 08	1.557E 08	1.464E 08	1.377E 08	1.288E 08
14500	2.695E 08	2.479E 08	2.241E 08	2.019E 08	1.834E 08	1.576E 08	1.479E 08	1.390E 08	1.302E 08
15000	2.724E 08	2.526E 08	2.294E 08	2.070E 08	1.875E 08	1.596E 08	1.493E 08	1.403E 08	1.315E 08
15500	2.747E 08	2.563E 08	2.344E 08	2.118E 08	1.914E 08	1.616E 08	1.509E 08	1.415E 08	1.327E 08
16000	2.764E 08	2.593E 08	2.388E 08	2.164E 08	1.954E 08	1.638E 08	1.525E 08	1.428E 08	1.339E 08
16500	2.777E 08	2.616E 08	2.424E 08	2.207E 08	1.993E 08	1.661E 08	1.541E 08	1.441E 08	1.350E 08
17000	2.788E 08	2.634E 08	2.454E 08	2.245E 08	2.031E 08	1.684E 08	1.558E 08	1.454E 08	1.361E 08
17500	2.798E 08	2.649E 08	2.479E 08	2.279E 08	2.067E 08	1.708E 08	1.574E 08	1.468E 08	1.373E 08
18000	2.807E 08	2.662E 08	2.499E 08	2.309E 08	2.101E 08	1.732E 08	1.595E 08	1.482E 08	1.384E 08
18500	2.814E 08	2.672E 08	2.516E 08	2.335E 08	2.132E 08	1.757E 08	1.613E 08	1.494E 08	1.396E 08
19000	2.825E 08	2.682E 08	2.530E 08	2.357E 08	2.160E 08	1.781E 08	1.632E 08	1.518E 08	1.408E 08
19500	2.835E 08	2.691E 08	2.542E 08	2.375E 08	2.184E 08	1.805E 08	1.651E 08	1.525E 08	1.420E 08
20000	2.844E 08	2.700E 08	2.553E 08	2.392E 08	2.208E 08	1.828E 08	1.670E 08	1.540E 08	1.433E 08
20500	2.850E 08	2.742E 08	2.589E 08	2.439E 08	2.274E 08	1.912E 08	1.743E 08	1.599E 08	1.483E 08
21000	2.852E 08	2.818E 08	2.633E 08	2.475E 08	2.320E 08	1.979E 08	1.809E 08	1.654E 08	1.532E 08
21500	2.852E 08	2.894E 08	2.704E 08	2.518E 08	2.357E 08	2.031E 08	1.863E 08	1.708E 08	1.578E 08
22000	2.854E 08	3.113E 08	2.813E 08	2.579E 08	2.394E 08	2.072E 08	1.908E 08	1.753E 08	1.619E 08
30000	3.603E 08	3.276E 08	2.948E 08	2.647E 08	2.440E 08	2.107E 08	1.945E 08	1.791E 08	1.655E 08
30500	3.700E 08	3.407E 08	3.084E 08	2.744E 08	2.514E 08	2.141E 08	1.979E 08	1.825E 08	1.684E 08
31000	3.737E 08	3.502E 08	3.202E 08	2.884E 08	2.593E 08	2.178E 08	2.011E 08	1.855E 08	1.715E 08
31500	3.839E 08	3.571E 08	3.294E 08	2.989E 08	2.680E 08	2.220E 08	2.043E 08	1.884E 08	1.741E 08
32000	3.904E 08	3.630E 08	3.345E 08	3.077E 08	2.777E 08	2.248E 08	2.078E 08	1.912E 08	1.764E 08
40000	4.018E 08	3.694E 08	3.423E 08	3.149E 08	2.857E 08	2.322E 08	2.117E 08	1.942E 08	1.791E 08
42000	4.139E 08	3.774E 08	3.479E 08	3.206E 08	2.926E 08	2.378E 08	2.150E 08	1.973E 08	1.816E 08
44000	4.279E 08	3.874E 08	3.543E 08	3.261E 08	2.984E 08	2.434E 08	2.201E 08	2.005E 08	1.841E 08
46000	4.413E 08	3.987E 08	3.618E 08	3.315E 08	3.038E 08	2.488E 08	2.245E 08	2.039E 08	1.867E 08
48000	4.529E 08	4.104E 08	3.705E 08	3.373E 08	3.087E 08	2.539E 08	2.289E 08	2.073E 08	1.893E 08
50000	4.624E 08	4.214E 08	3.800E 08	3.438E 08	3.135E 08	2.584E 08	2.332E 08	2.108E 08	1.920E 08
60000	5.036E 08	4.605E 08	4.213E 08	3.813E 08	3.084E 08	2.787E 08	2.510E 08	2.271E 08	2.053E 08
70000	5.542E 08	5.024E 08	4.540E 08	4.113E 08	3.399E 08	2.989E 08	2.683E 08	2.414E 08	2.174E 08
80000	5.924E 08	5.407E 08	4.902E 08	4.410E 08	3.563E 08	3.190E 08	2.851E 08	2.553E 08	2.293E 08

120000	6.837E 08	6.383E 08	5.894E 08	5.373E 08	4.837E 08	4.329E 08	3.857E 08	3.424E 08	3.042E 08	2.711E 08
150000	7.060E 08	6.635E 08	6.191E 08	5.727E 08	5.244E 08	4.743E 08	4.242E 08	3.764E 08	3.335E 08	2.704E 08
200000	7.222E 08	6.811E 08	6.398E 08	5.977E 08	5.549E 08	5.101E 08	4.635E 08	4.162E 08	3.700E 08	3.272E 08
250000	7.343E 08	6.932E 08	6.521E 08	6.109E 08	5.695E 08	5.270E 08	4.834E 08	4.387E 08	3.933E 08	3.491E 08
300000	7.459E 08	7.056E 08	6.642E 08	6.229E 08	5.815E 08	5.390E 08	4.957E 08	4.520E 08	4.085E 08	3.644E 08
350000	7.574E 08	7.188E 08	6.773E 08	6.356E 08	5.942E 08	5.517E 08	5.084E 08	4.647E 08	4.212E 08	3.758E 08
400000	8.237E 08	7.597E 08	6.973E 08	6.443E 08	5.981E 08	5.550E 08	5.128E 08	4.704E 08	4.279E 08	3.849E 08
450000	8.647E 08	8.016E 08	7.380E 08	6.739E 08	6.157E 08	5.658E 08	5.210E 08	4.780E 08	4.353E 08	3.924E 08
500000	9.173E 08	8.406E 08	7.712E 08	7.074E 08	6.441E 08	5.843E 08	5.323E 08	4.841E 08	4.423E 08	3.992E 08
600000	9.724E 08	9.094E 08	8.414E 08	7.681E 08	6.949E 08	6.319E 08	5.690E 08	5.114E 08	4.594E 08	4.129E 08
700000	9.979E 08	9.393E 08	8.781E 08	8.140E 08	7.473E 08	6.763E 08	6.080E 08	5.447E 08	4.852E 08	4.309E 08
800000	1.010E 09	9.547E 08	8.922E 08	8.391E 08	7.774E 08	7.120E 08	6.443E 08	5.761E 08	5.123E 08	4.529E 08
900000	1.019E 09	9.641E 08	9.092E 08	8.534E 08	7.959E 08	7.340E 08	6.712E 08	6.044E 08	5.377E 08	4.747E 08
1000000	1.024E 09	9.717E 08	9.172E 08	8.624E 08	8.048E 08	7.494E 08	6.911E 08	6.299E 08	5.603E 08	4.932E 08
1200000	1.039E 09	9.847E 08	9.303E 08	8.759E 08	8.214E 08	7.644E 08	7.104E 08	6.524E 08	5.914E 08	5.285E 08
1500000	1.053E 09	1.000E 09	9.462E 08	8.918E 08	8.374E 08	7.830E 08	7.283E 08	6.731E 08	6.168E 08	5.585E 08
2000000	1.073E 09	1.021E 09	9.663E 08	9.122E 08	8.579E 08	8.035E 08	7.491E 08	6.945E 08	6.397E 08	5.843E 08
2500000	1.091E 09	1.037E 09	9.824E 08	9.280E 08	8.737E 08	8.193E 08	7.650E 08	7.105E 08	6.559E 08	6.011E 08
3000000	1.105E 09	1.050E 09	9.958E 08	9.413E 08	8.868E 08	8.323E 08	7.779E 08	7.235E 08	6.690E 08	6.143E 08
3500000	1.114E 09	1.061E 09	1.007E 09	9.526E 08	8.981E 08	8.435E 08	7.890E 08	7.345E 08	6.800E 08	6.254E 08
4000000	1.123E 09	1.071E 09	1.017E 09	9.622E 08	9.078E 08	8.533E 08	7.988E 08	7.442E 08	6.894E 08	6.350E 08
4500000	1.134E 09	1.079E 09	1.025E 09	9.705E 08	9.162E 08	8.618E 08	8.073E 08	7.528E 08	6.982E 08	6.434E 08
5000000	1.141E 09	1.087E 09	1.032E 09	9.780E 08	9.236E 08	8.693E 08	8.148E 08	7.604E 08	7.058E 08	6.512E 08
6000000	1.154E 09	1.100E 09	1.045E 09	9.909E 08	9.366E 08	8.822E 08	8.278E 08	7.734E 08	7.189E 08	6.644E 08
7000000	1.165E 09	1.111E 09	1.056E 09	1.002E 09	9.475E 08	8.931E 08	8.387E 08	7.843E 08	7.299E 08	6.755E 08
8000000	1.174E 09	1.120E 09	1.064E 09	1.011E 09	9.569E 08	9.026E 08	8.482E 08	7.938E 08	7.394E 08	6.850E 08
9000000	1.183E 09	1.128E 09	1.074E 09	1.020E 09	9.653E 08	9.109E 08	8.565E 08	8.022E 08	7.478E 08	6.938E 08
10000000	1.190E 09	1.134E 09	1.081E 09	1.027E 09	9.728E 08	9.184E 08	8.640E 08	8.094E 08	7.552E 08	7.008E 08

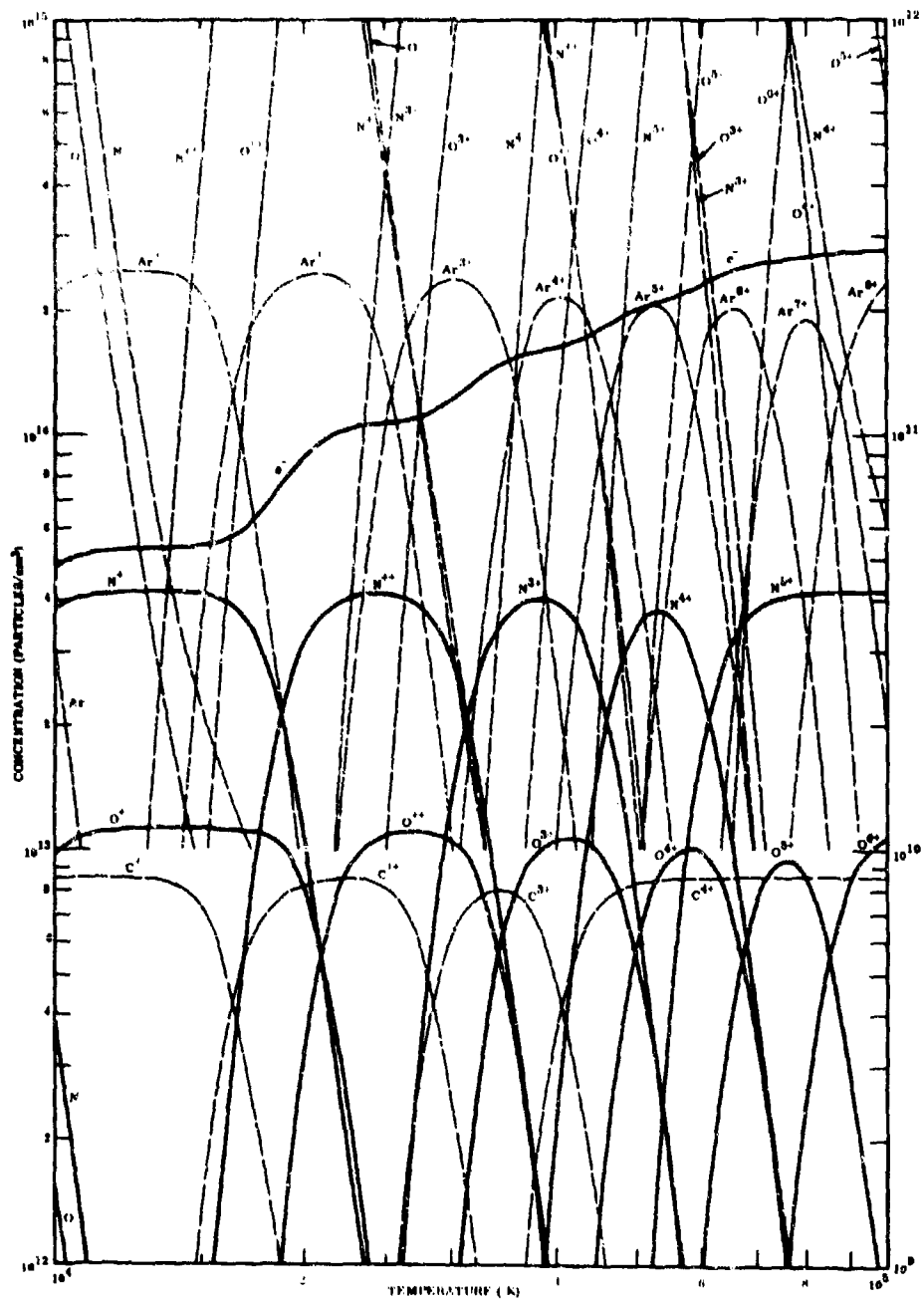


FIG. 2-1 EQUILIBRIUM COMPOSITION OF AIR AT  $\rho/\rho_0 = 10^{-6}$   
 SOLID CURVES: USE LEFT-HAND SCALE,  
 BROKEN CURVES: USE RIGHT-HAND SCALE

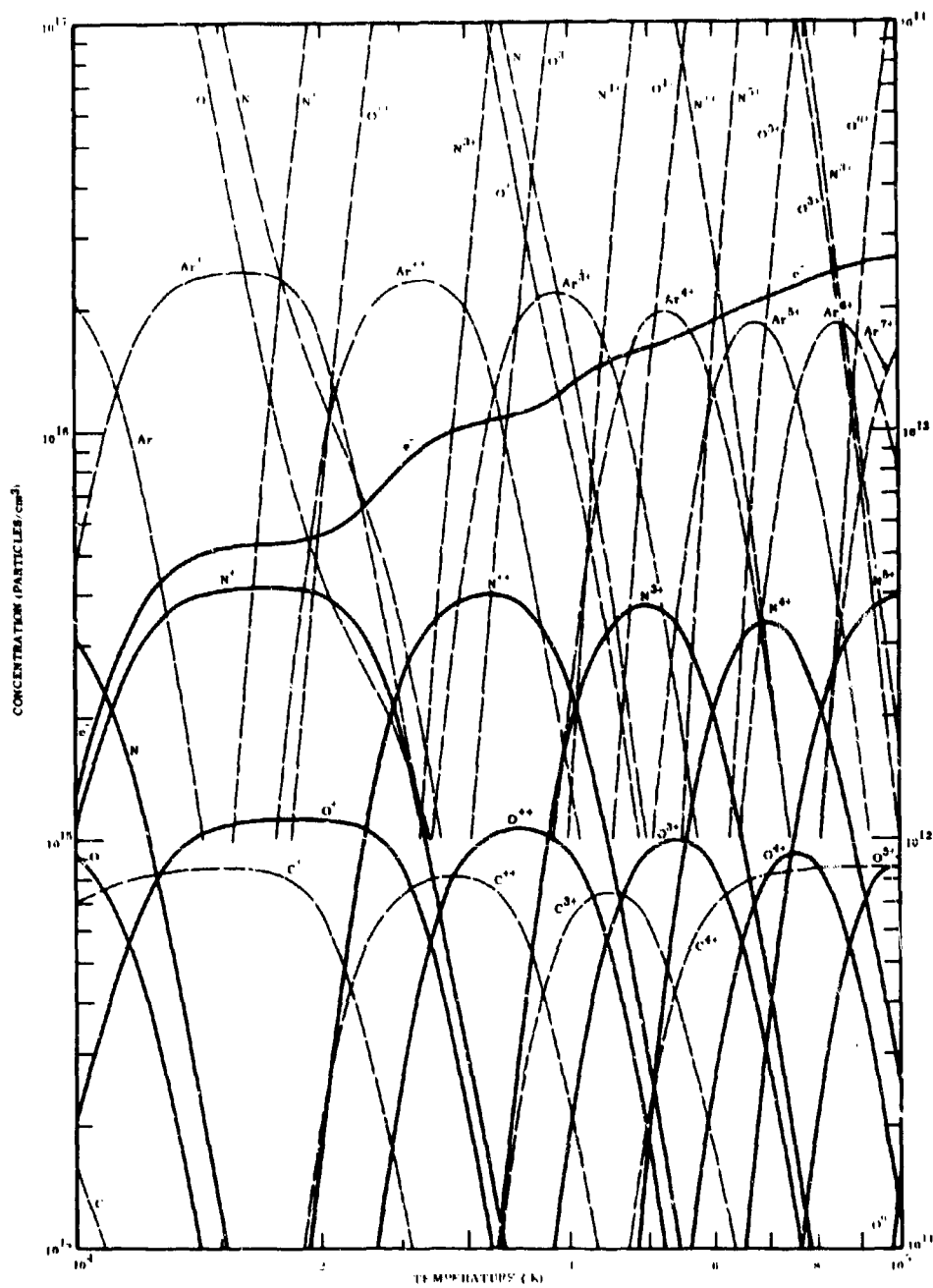


FIG. 2-2 EQUILIBRIUM COMPOSITION OF AIR AT  $\rho/\rho_0 = 10^{-4}$   
 SOLID CURVES: USE LEFT-HAND SCALE,  
 BROKEN CURVES: USE RIGHT-HAND SCALE

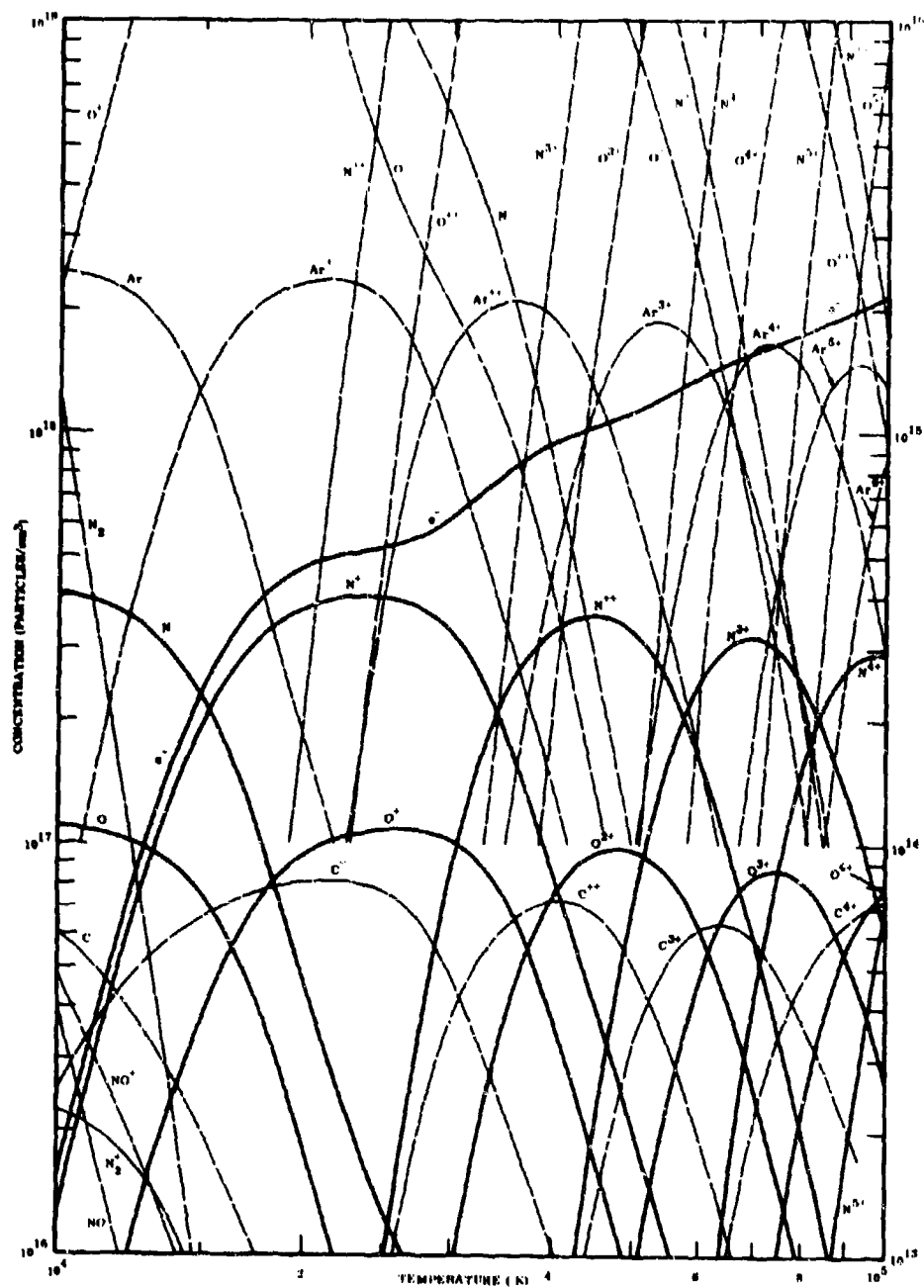


FIG. 2-3 EQUILIBRIUM COMPOSITION OF AIR AT  $\rho/\rho_0 = 10^{-2}$   
 SOLID CURVES: USE LEFT-HAND SCALE,  
 BROKEN CURVES: USE RIGHT-HAND SCALE

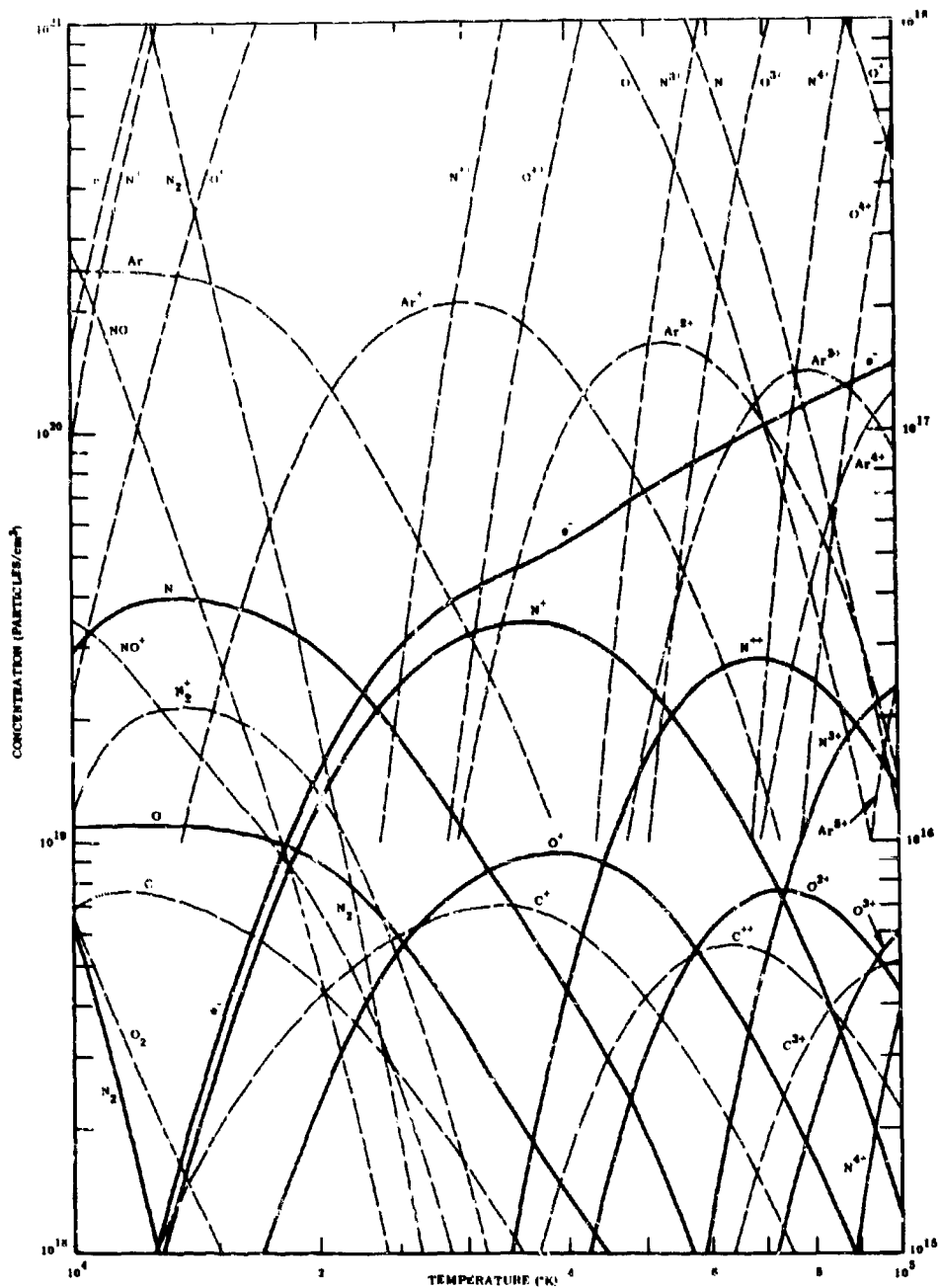


FIG. 2-4 EQUILIBRIUM COMPOSITION OF AIR AT  $p/p_0 = 1$   
 SOLID CURVES: USE LEFT-HAND SCALE,  
 BROKEN CURVES: USE RIGHT-HAND SCALE

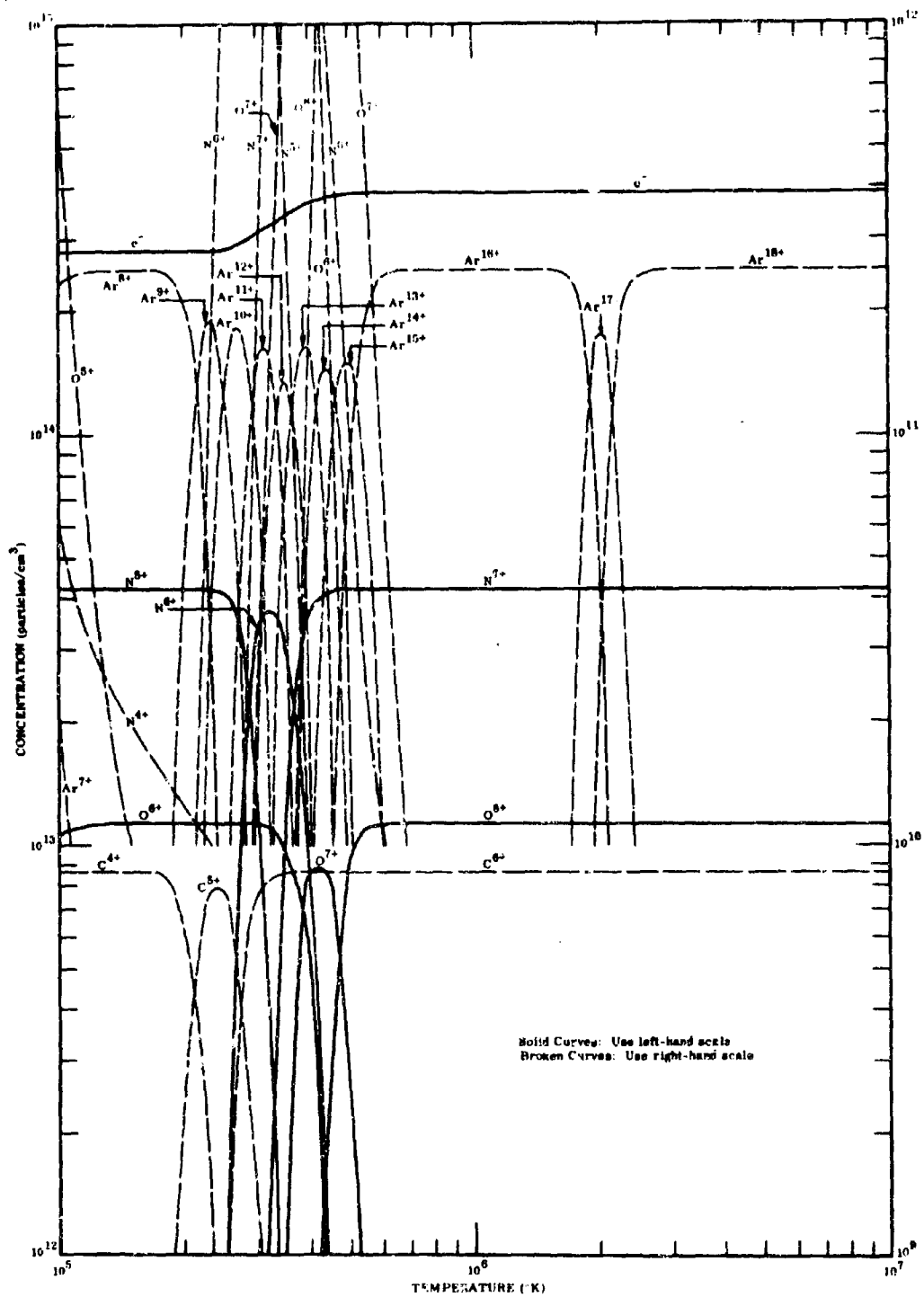


FIG. 2-5 EQUILIBRIUM COMPOSITION OF AIR AT  $\rho/\rho_0 = 10^{-6}$

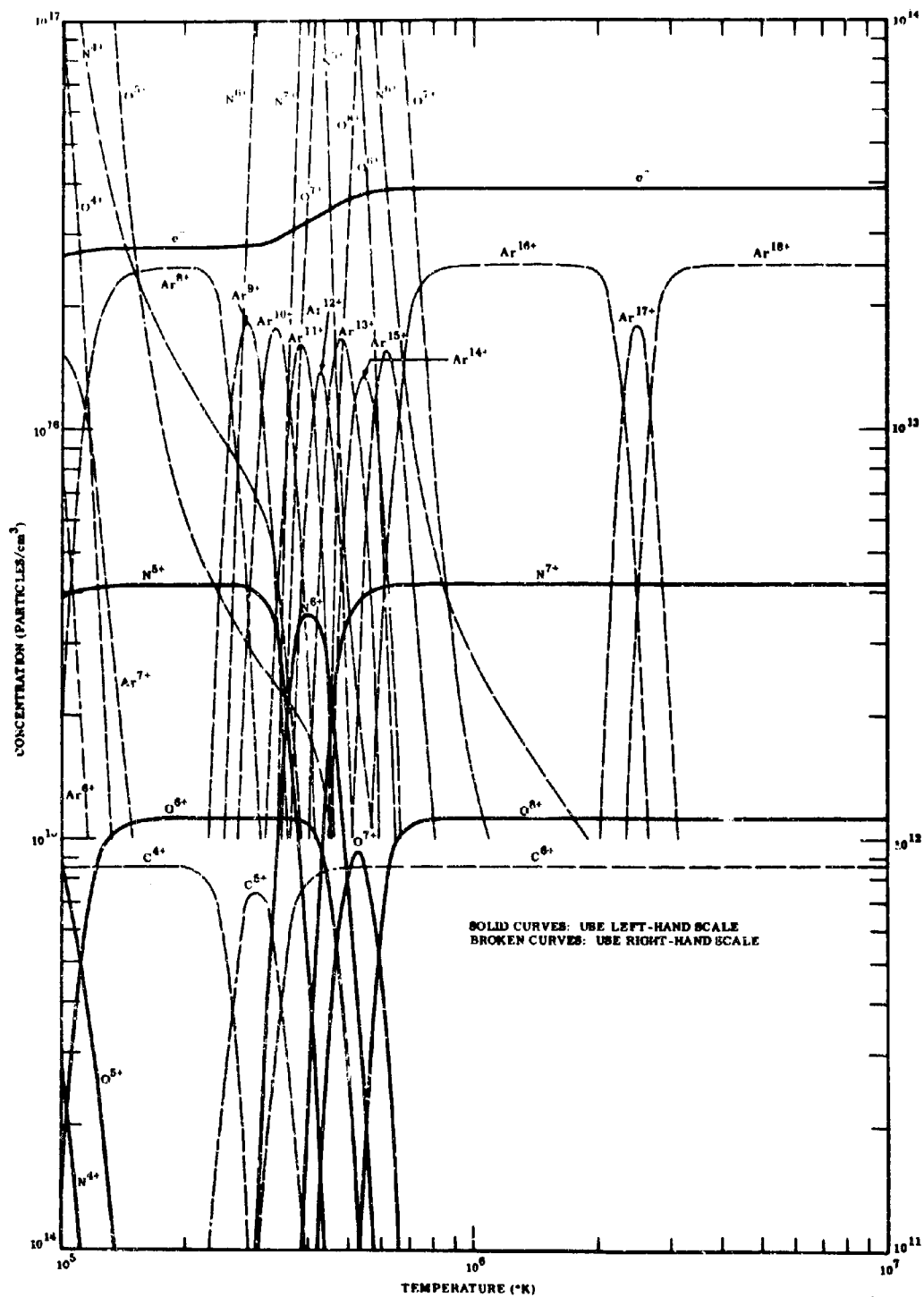


FIG. 2-6 EQUILIBRIUM COMPOSITION OF AIR AT  $\rho/\rho_0 = 10^{-4}$



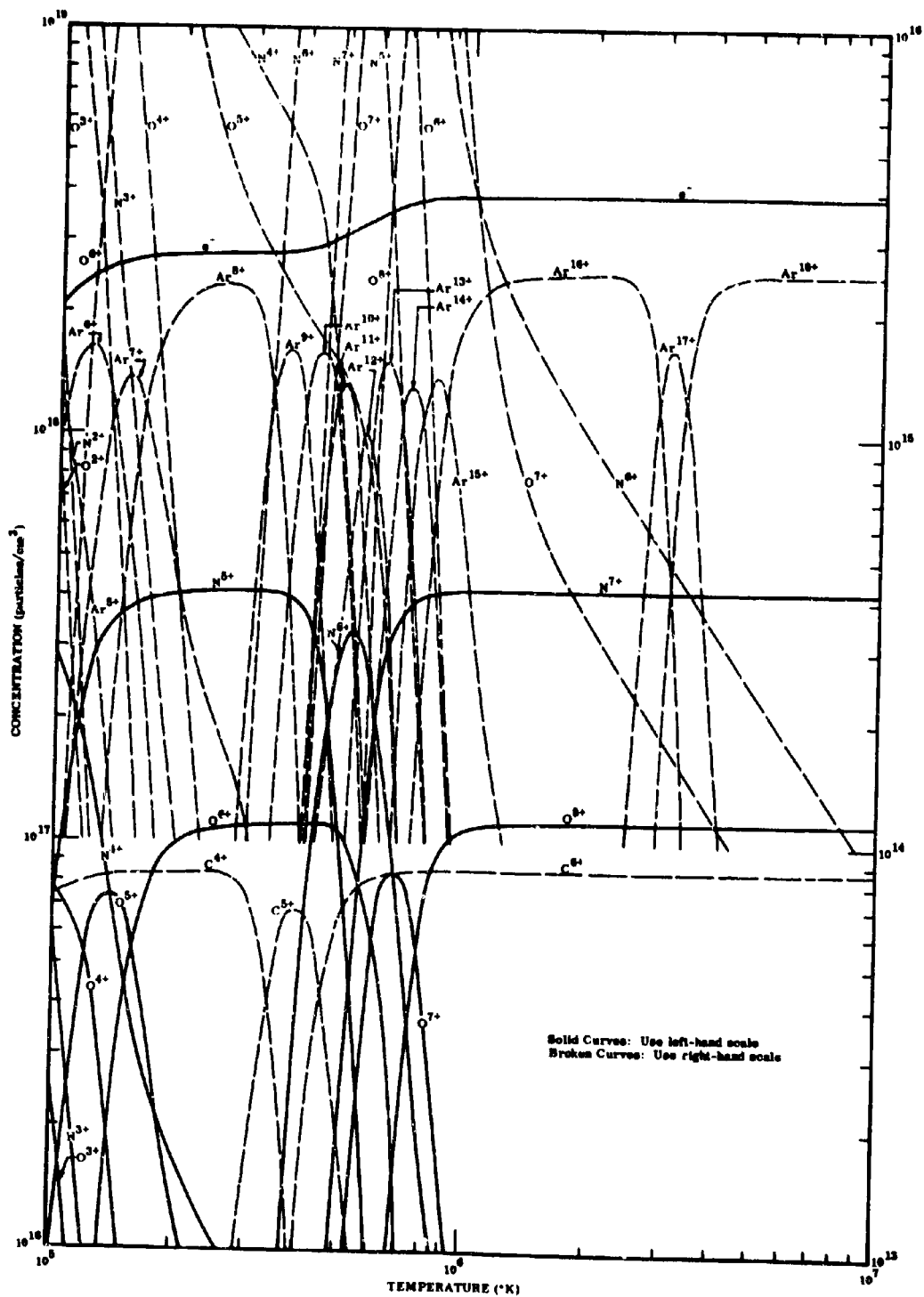


FIG. 2-7 EQUILIBRIUM COMPOSITION OF AIR AT  $\rho/\rho_0 = 10^{-2}$

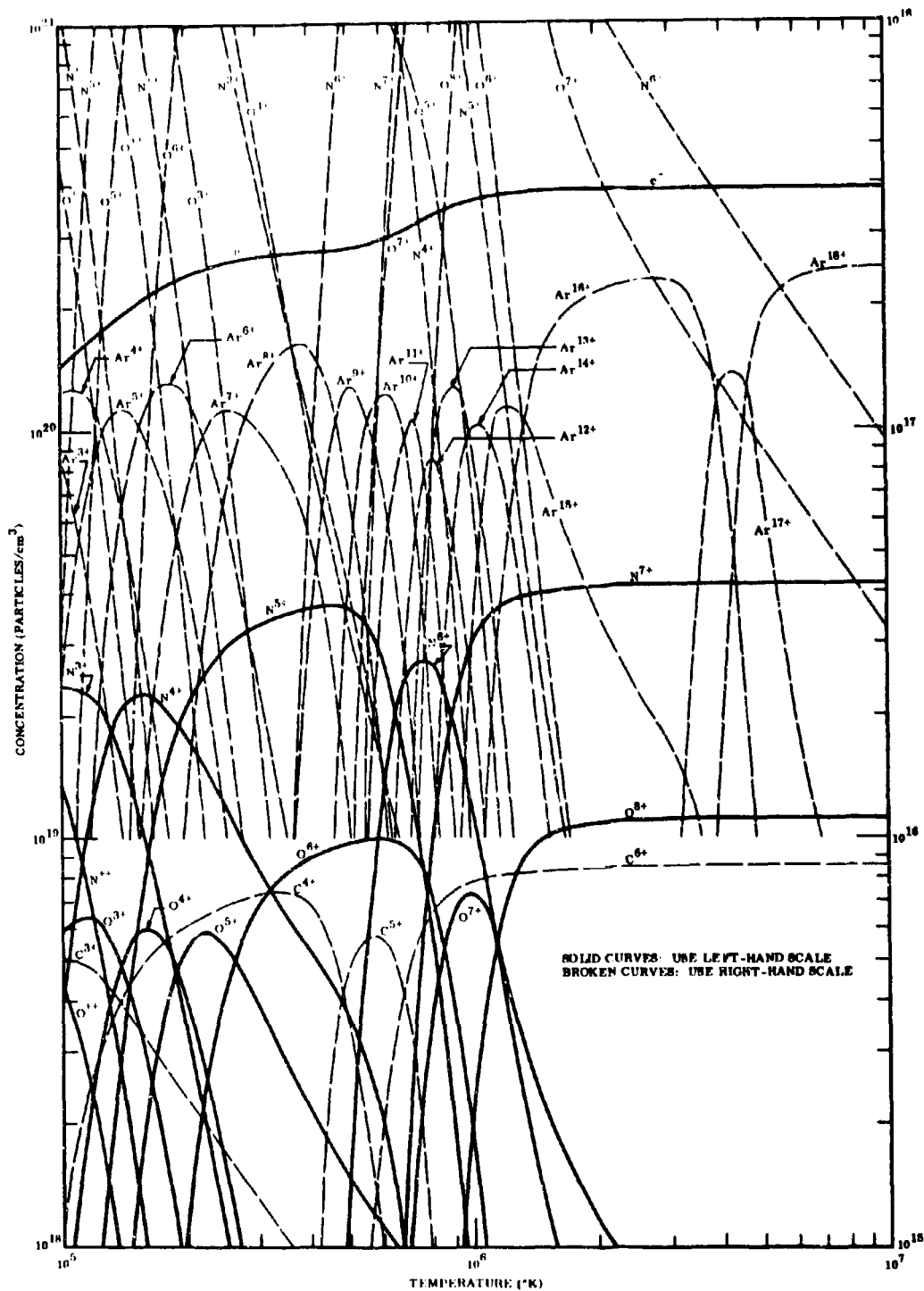


FIG. 2-8 EQUILIBRIUM COMPOSITION OF AIR AT  $\rho/\rho_0 = 1$

**Appendix A. Composition and Properties of the Atmosphere\***  
(written by A.D. Anderson)

In this Appendix the main characteristics of the atmosphere are reviewed. The principal regions of the earth's atmosphere are given in Table A-1. Inasmuch as the dominant process in the atmosphere is mixing up to at least 90 km, the proportions of the major constituents are constant up to this altitude. Hence, the mean molecular weight (mass) remains the same from 0 to 90 km and the region is called the "homosphere". Above 90 km, the molecular weight decreases as the composition changes with altitude, because of molecular dissociation and diffusion. This region is called the "heterosphere".

Aside from the compositions of the homosphere and heterosphere, we have also summarized the physics of the upper atmosphere with particular attention to variation of properties and composition with the solar cycle, a subject which has received much recent study.

Composition of the homosphere (lower atmosphere). The composition of dry air near sea level is presented in Table A-2 (U.S. Standard Atmosphere, 1962). Table A-3 gives property values for the homosphere as taken from the U.S. Standard Atmosphere, 1962 (1962). The molecular weight from 0 to 90 km is 28.964. The U.S. Standard Atmosphere, 1962, is a middle-latitude (approximately 45°) year-round mean over the range of solar activity between sunspot minima and sunspot maxima. Seasonal and latitudinal variations of the lower atmosphere properties can be taken into account, if desired, by using values from supplemental atmospheres derived by Cole and Kantor (1963).

---

\* Some of this material has appeared in Space Materials Handbook, Ch. 4, published by Addison-Wesley Pub. Co., 1965, edited by C.G. Goetzl, J.B. Rittenhouse and J.B. Singletary.

**TABLE A-1. Principal regions of the earth's atmosphere**

<b>Atmospheric region</b>	<b>Sub-region</b>	<b>Approximate altitude range (km)</b>	<b>Characteristic features</b>
<b>Homosphere</b>	<b>Troposphere</b>	<b>0-12</b>	<b>Mean molecular weight constant; heat transfer by convection</b>
	<b>Stratosphere</b>	<b>12-50</b>	<b>Constant molecular weight; increasing temperature, region strongly heated by both earth infrared and solar ultraviolet radiation</b>
	<b>Mesosphere</b>	<b>50-90</b>	<b>Constant molecular weight; decreasing temperature. Mixing processes dominant throughout homosphere</b>
<b>Heterosphere</b>	<b>Thermosphere</b>	<b>90-550</b>	<b>Frequent particle collisions; diffusion process dominant</b>
	<b>Exosphere</b>	<b>550-60,000</b>	<b>Collisions rare; temperature constant with altitude to about 8500 km; diffusion process dominant; heat transfer by conduction.</b>

TABLE A-2. Normal composition of clean, dry atmospheric air  
near sea level from U. S. Standard Atmosphere, 1962.

Constituent gas	Content (per cent by volume)	Molecular weight (C <sup>12</sup> = 12.0000)
Molecular nitrogen	78.084	28.0134
Molecular oxygen	20.9476	31.9988
Argon	0.934	39.948
Carbon dioxide	0.0314	44.00995
Neon	0.001818	20.183
Helium	0.000524	4.026
Krypton	0.000114	83.80
Xenon	0.0000087	131.30
Molecular hydrogen	0.00005	2.01594
Methane	0.0002	16.04303
Nitrous oxide	0.00005	44.0128
Sulfur dioxide	0 to 0.0001	64.0628
Ozone	Summer: 0 to 0.000007 Winter: 0 to 0.000002	47.9982
Nitrogen dioxide	0 to 0.000002	46.0055
Ammonia	0 to trace	17.03061
Carbon monoxide	0 to trace	28.01055
Iodine	0 to 0.000001	253.8088

TABLE A-3. Lower atmosphere neutral properties versus altitude (U.S. Standard Atmosphere, 1962).

Altitude $h$ (km)	Temperature $T$ (°K)	Scale Height (km)	Concentration $n$ (cm <sup>-3</sup> )	Pressure (dynes cm <sup>-2</sup> )	Density (gm cm <sup>-3</sup> )
0	288	8.4	2.54(19)*	1.01(6)	1.22(-3)
5	256	7.5	1.53(19)	5.46(5)	7.36(-4)
10	223	6.6	8.60(16)	2.65(5)	4.24(-4)
15	217	6.4	4.05(16)	1.21(5)	1.95(-4)
20	217	6.4	1.85(16)	5.53(4)	8.89(-5)
25	222	6.5	8.33(17)	2.55(4)	4.00(-5)
30	226	6.7	3.82(17)	1.20(4)	1.84(-5)
35	236	7.0	1.76(17)	5.75(3)	8.46(-6)
40	250	7.4	8.31(16)	2.87(3)	4.00(-6)
45	264	7.8	4.09(16)	1.49(3)	1.97(-6)
50	271	8.0	2.14(16)	7.98(2)	1.09(-6)
60	256	7.6	6.36(15)	2.25(2)	3.06(-7)
70	220	6.6	1.82(15)	5.52(1)	8.75(-8)
80	181	5.4	4.16(14)	1.04(1)	2.00(-8)
90	181	5.4	6.60(13)	1.64	3.17(-9)

\*Denotes  $n = 2.54 \times 10^{19}$  particles cm<sup>-3</sup>

Minor constituents in the homosphere. Despite the general constancy of the proportions of the major constituents in the homosphere, photochemical and collision mechanisms result in major changes with altitude in the concentrations of the minor constituents. In spite of their small concentrations, some of these minor constituents can be very important. For example, although water vapor usually comprises less than 3 per cent of the gases even with moist conditions at sea level, it absorbs nearly six times as much solar radiant energy as do all the other gases combined. Furthermore, it accounts for nearly all the gaseous absorption of the terrestrial infrared radiation.

Atomic oxygen is present as a minor constituent of the mesosphere, as a result of photodissociation. Detection of the sodium D lines in the night airglow and twilight flash demonstrates the presence of sodium in the mesosphere. Carbon dioxide and the oxides of nitrogen have also been detected in the mesosphere by mass spectrometers of rocket flights. The presence of water vapor in the stratosphere and mesosphere is inferred from the detection of the hydroxyl radical in the night airglow.

Carbon dioxide is also an important absorber of infrared radiation. Many measurements have been made to determine the  $\text{CO}_2$  content of the atmosphere. Bray (1959) has weighted the various measurements and gives a median value of 320 ppm. Most of the carbon dioxide measurements have been taken at sea level. Glueckauf (1944) reports values that vary from 250 ppm to 300 ppm for a series of balloon flights over England. He indicates that samples taken in the stratosphere were not different from those taken at ground level. Measurements indicate that the minimum concentrations of  $\text{CO}_2$  are approximately 150 ppm and are found in polar air; however, the polar air values vary widely. The maximum concentrations have been measured off the west coast of Africa and may rise to 700 ppm locally. The  $\text{CO}_2$  concentration is greater in urban than in rural areas, continental air masses show higher concentrations than air masses over the oceans, and night air usually contains more  $\text{CO}_2$  than daytime air.

Water vapor is the most variable constituent in the atmosphere and is perhaps the most difficult to measure at small concentrations and at low temperatures. Measurements indicate that the mixing ratio of water vapor in the atmosphere decreases rapidly from ground level to the tropopause. In the stratosphere, the vapor content changes more slowly and usually decreases with altitude. Since the maximum concentration of water vapor is temperature dependent, its normal altitude profile is in accord with the temperature profile in the atmosphere. Gutnick (1962) has derived a water vapor profile for temperate latitudes, based on the best water vapor measurements to date. The general features of this model are that the mixing ratio decreases from about 6,150 ppm (mg/kg) at the surface to 9 ppm at 16 km, then increases slightly with altitude. However, the water vapor increase above 16 km is now considered dubious. Bandeen et al. (1969) infer the relative planetary distribution of atmospheric moisture from measurement within the 6.3 micron band of water vapor made from Tiros meteorological satellites.

Ozone, produced by the action of solar ultraviolet radiation on molecular oxygen, is found between 15 and 40 km, with peak values between 22 and 35 km. The total amount of ozone in temperate latitudes is about 2.7 mm on the average for the whole year; that is, if the total amount of ozone in the atmosphere could be concentrated at the surface it would make a layer of this height at STP. There are considerable changes in the amount of ozone from day to day which are correlated with weather changes. In particular the relation to pressure changes is well indicated. Ozone also appears to have a slight seasonal and latitudinal variation. Figure A-1 shows the measurements for various latitudes reported by Miller (1960). The ozone distributions shown in the figure can be considered as representative of the atmosphere over the Tropical, Temperate, and Arctic regions of the earth. Atmospheric absorption by ozone is most important in the ultraviolet region of the spectrum and near 9.6 microns in the infrared; a minor absorption band also occurs near 4.8 microns. A good review article on ozone has been presented by Götz (1951).



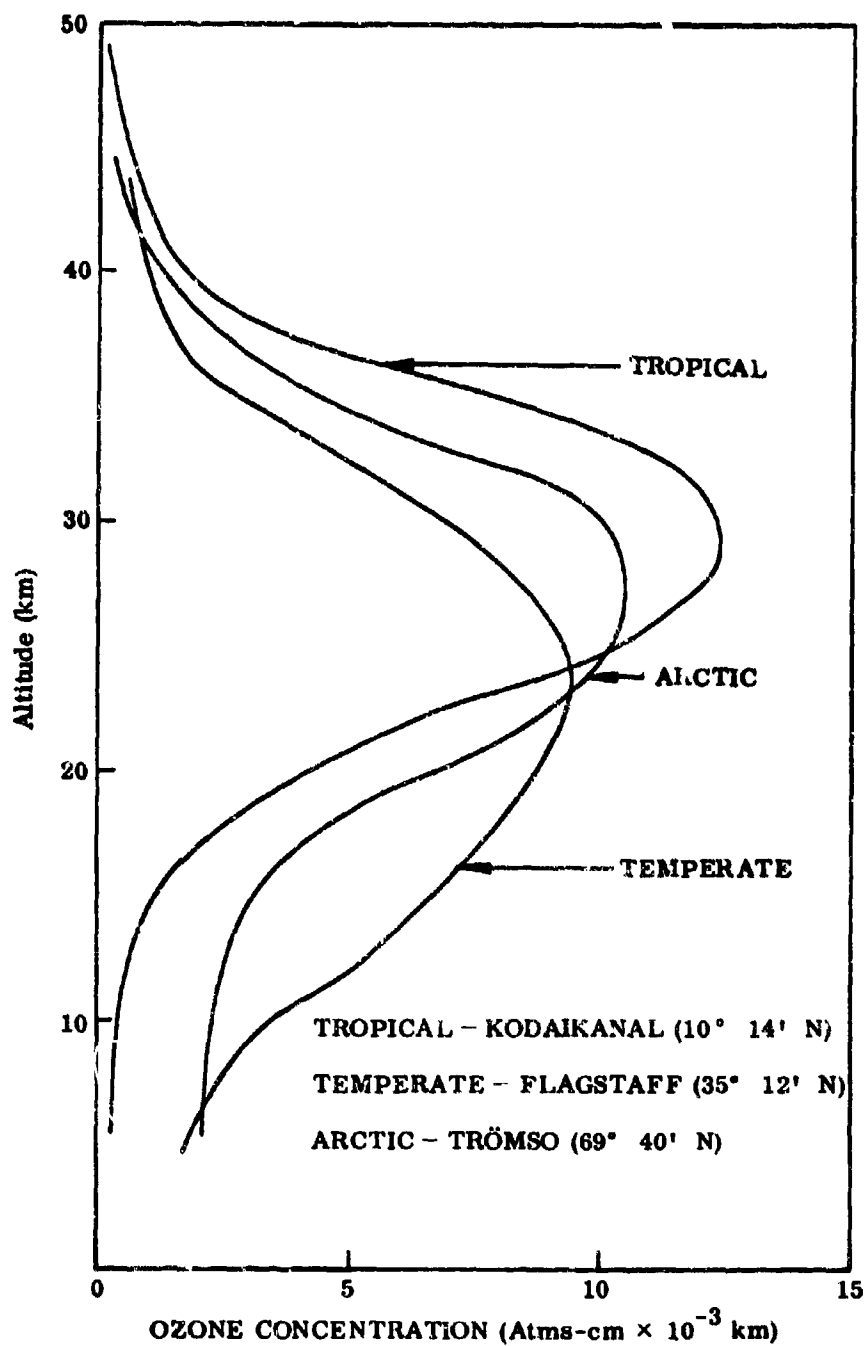


FIG. A-1 OZONE DISTRIBUTION

Composition of the heterosphere (upper atmosphere). The neutral atmosphere above 100 km is composed almost wholly of molecular nitrogen and oxygen and atomic nitrogen, oxygen, helium, and hydrogen; the relative concentrations of these constituents depend strongly on altitude and temperature. The composition of the upper atmosphere can be explained, at least in a qualitative sense, by noting the types of photochemical reactions that can occur and how the reaction products are affected by mixing and diffusion. In the following paragraphs, the reactions leading to the neutral constituents will be discussed first, followed by the ion reactions.

At about 100 km, the absorption of solar radiation with wavelengths shorter than 1850Å down to about 1300Å leads to the dissociation of oxygen molecules into oxygen atoms. For wavelengths shorter than 1026Å, the oxygen molecule can be ionized; this ionization is normally followed by a dissociative recombination producing atomic oxygen. Although the oxygen atoms can recombine into molecules, photochemical equilibrium, where the rates of dissociation and recombination are equal at each altitude, does not prevail. Instead, vertical transport due to both diffusion and mixing plays an important role in determining the atomic and molecular concentrations at various levels near 100 km. More oxygen dissociates than recombines above 100 km, due to the rapid fall-off with altitude of the recombination processes. Below 100 km, collisions occur frequently enough for recombination to prevail, hence more oxygen recombines than dissociates. Consequently, there is a steady flux of molecular oxygen upward and atomic oxygen downward through the 100 km level, due to the effects of diffusion and mixing. Atomic oxygen is the most important constituent in the upper thermosphere.

The most active process leading to the dissociation of molecular nitrogen is ionization followed by dissociative recombination, producing

atomic nitrogen. Atomic nitrogen can react with molecular oxygen to form nitric oxide and atomic oxygen. The nitric oxide in turn reacts with atomic nitrogen to form molecular nitrogen and atomic oxygen. The effectiveness of these reactions, together with the slowness with which molecular nitrogen dissociates, causes atmospheric nitrogen to remain predominantly in molecular form.

Photodissociation of water vapor and methane near 80 km constitute the principal sources of atomic hydrogen. Owing to the small mass of the hydrogen atom compared to other atmospheric constituents, the hydrogen concentration does not decrease with altitude as rapidly as do the other atmospheric constituents in the altitude region where diffusion proceeds rapidly; hence atomic hydrogen becomes an increasingly important atmospheric constituent with increasing altitude. However, atomic hydrogen is such a minor constituent in the thermosphere that it does not become the dominant constituent until 2000 to 5000 km altitude, remaining so until about 20,000 km where the hydrogen ion becomes dominant. The source of atomic hydrogen near 80 km can be expected to remain essentially constant through the sunspot cycle, but the rate of escape, depending on the temperature at the base of the exosphere, varies with the sunspot cycle. The escape will be relatively rapid when the temperature is high, and the concentration of hydrogen will be correspondingly low in the exosphere near sunspot maximum. The escape is relatively slow when the temperature is low, so that the concentration must be comparatively high near sunspot minimum.

Nicolet (1961) showed that helium atoms are an important constituent in the lower exosphere. He explains the high densities derived from the rate of change of the period of the Echo satellite by the presence of helium. Evidently, atomic oxygen, nitrogen or hydrogen cannot explain the slow density decrease between 750 and 1500 km. Atomic oxygen is the most important constituent in the upper thermosphere, but atomic helium

dominates over atomic oxygen somewhere above 800 to 1000 km. Atomic hydrogen dominates over helium somewhere above 2000 to 5000 km. Although the total concentration of the neutral particles is at least an order of magnitude greater than that of the ions up to about 2000 km altitude, the ion concentrations finally become significant at the higher altitudes.

The primary ions formed in the E region (85 to 140 km) of the ionosphere are  $N_2^+$ ,  $O_2^+$ , and  $O^+$ . The  $N_2^+$  ions dissociatively recombine very rapidly, and they may also react with oxygen, so that the concentration of  $N_2^+$  is small. Ion-atom exchange reactions of the type



proceed very rapidly, so that the reactions of  $O^+$  with  $O_2$  and  $N_2$  quickly remove the  $O^+$  ions and produce either  $NO^+$  or  $O_2^+$ . The dominant ions in the  $F_1$  region (140 to 200 km) are  $NO^+$  and  $O_2^+$  near the lower altitude boundary, with a gradual transition to  $O^+$  as the principal ion at the upper boundary.  $O^+$  becomes the dominant ion because of the rapid decrease with altitude of the neutral molecular constituents that otherwise would tend to eliminate  $O^+$  by reaction (A1.). In the  $F_2$  region (200 to 800 km), the ions present are  $O^+$  and  $N^+$ , with  $O^+$  greatly predominant. The helium ion starts to become dominant between 800 and 1400 km (Bourdeau and Bauer, 1963), depending on atmospheric temperature. Likewise, protons become the dominant ion between about 1400 to 4000 km. Thus, there are two transition regions (from oxygen to helium ions and from helium to hydrogen ions) in the upper ionosphere rather than a single transition from oxygen to hydrogen as previously believed. The outer portion of the earth's atmosphere (extending from about 20,000 km to at least 60,000 km above the earth's surface) consists

mainly of protons. The protons predominate in the earth's outer atmosphere over the hydrogen atoms because the confining effect of the earth's magnetic field makes their rate of escape to space much less than for the neutral hydrogen atoms. According to Johnson (1960), the solar wind cannot penetrate the geomagnetic field; therefore, the upper boundary of the earth's atmosphere and magnetic field (magnetosphere) are the same.

Even under normal solar wind conditions, the magnetosphere does not present a simple boundary to the earth's atmosphere. On the day side of the earth, a cavity, which is filled with the earth's magnetic field and atmosphere, is formed in the solar wind. At the same time, the geomagnetic field is deformed by the solar wind. A schematic representation of the cavity and deformed geomagnetic field during a moderately strong solar wind is shown in Fig. A-2 (Johnson, 1960). The boundary of the magnetic field in the direction facing the sun is about 10 earth radii from the center of the earth. The widest portion of the magnetic field downwind from the earth is more than 12 earth radii in width and may be over 18. The length of this tail is presently unknown and undoubtedly depends on the intensity and temperature of the particles in the solar wind.

Physics of the atmosphere. Assuming that the earth's atmosphere is a continuous medium consisting of a gas in static equilibrium, the equation connecting the pressure  $P$  and density  $\rho$  at any altitude  $h$  is

$$dP = -g\rho dh, \quad (A2.)$$

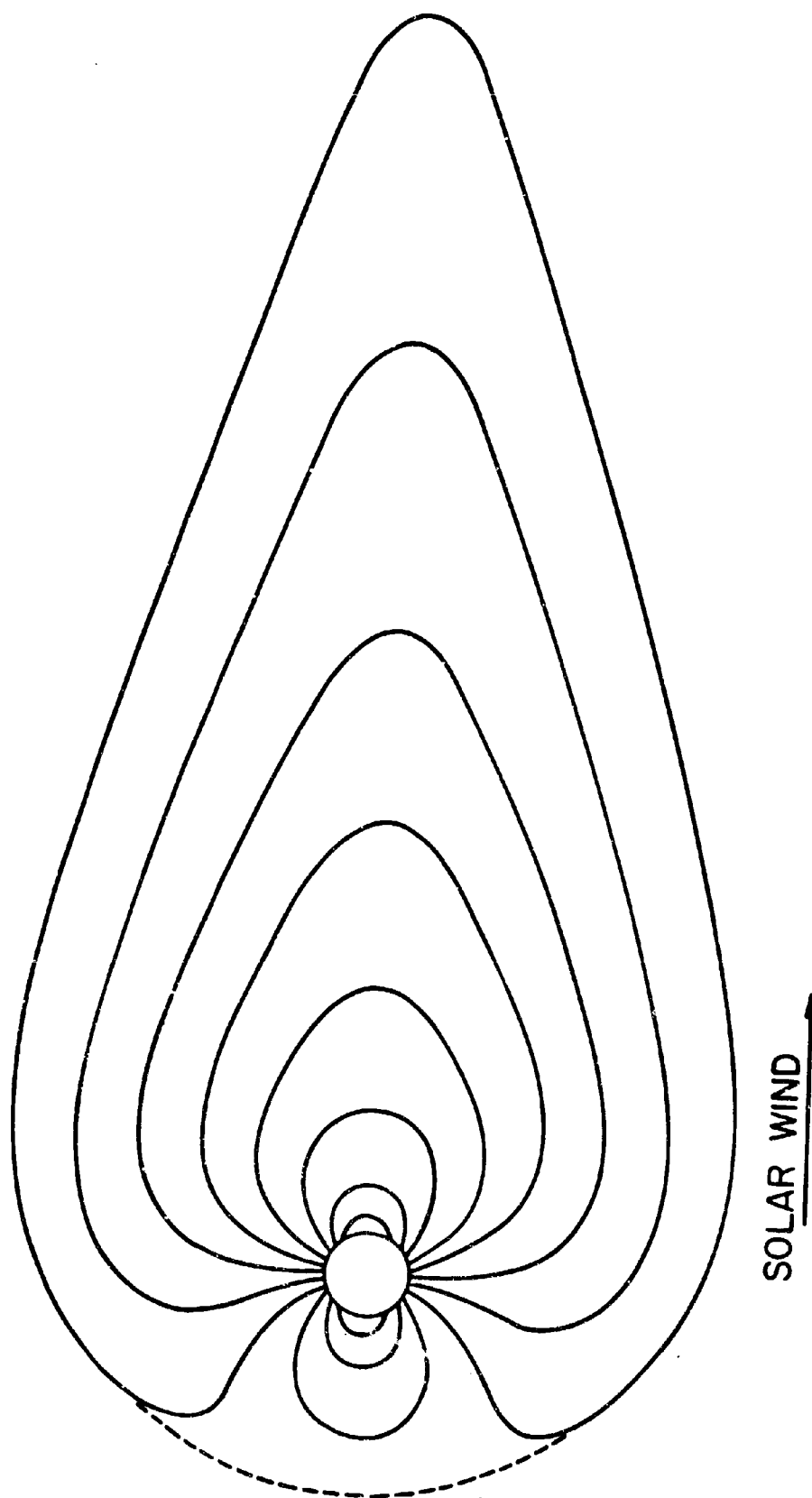


FIG. A-2 THE GEOMAGNETIC FIELD AS DEFORMED BY A MODERATELY STRONG SOLAR WIND BLOWING PERPENDICULARLY TO THE MAGNETIC AXIS, ACCORDING TO JOHNSON (1960)

where  $g$  is the gravitational acceleration. The variation in  $g$  with altitude can be taken into account by using the relationship

$$g = g_0 R_0^2 / (R_0 + h)^2 , \quad (A3.)$$

where  $g_0$  is the acceleration of gravity at the earth's surface and  $R_0$  is the earth's radius. Eq. (A2.) is the hydrostatic equation in differential form. Further, let  $m$  be the mean molecular mass of the gas and  $n$  denote the number density or concentration; the density  $\rho$  is then

$$\rho = n m . \quad (A4.)$$

Since the terrestrial atmosphere can be approximated by a perfect gas, the pressure is given by the equation of state

$$P = n k T , \quad (A5.)$$

where  $T$  is the temperature and  $k$  the Boltzmann constant ( $1.38 \times 10^{-16}$  erg deg<sup>-1</sup>).

Multiplying both sides of Eq. (A4.) by  $g$  and dividing the result into Eq. (A5.) gives

$$P/\rho \cdot g = k T/m g = H , \quad (A6.)$$

where  $H = k T/m g$  is known as the pressure scale height, a parameter convenient for atmospheric calculations.

From Eqs. (A2.) to (A4.) one can obtain

$$\frac{dP}{P} = - \frac{m g}{k T} dh . \quad (A7.)$$

Then, integrating Eq.(A7.) gives the barometric law

$$\frac{P}{P_0} = \exp \left[ - \int_0^h \frac{m g}{k T} dh \right] . \quad (A8)$$

From Eqs.(A5.) and (A8.) we have

$$\frac{n}{n_0} = \frac{T_0}{T} \exp \left[ - \int_0^h \frac{m g}{k T} dh \right] , \quad (A9)$$

and Eqs.(A4.) and (A9.) yield

$$\frac{\rho}{\rho_0} = \frac{m T_0}{m_0 T} \exp \left[ - \int_0^h \frac{m g}{k T} dh \right] . \quad (A10)$$

In Eqs.(A8.) to (A10.),  $P$ ,  $n$ , and  $\rho$  are the pressure, particle concentration, and density, respectively, at altitude  $h$ , and  $P_0$ ,  $n_0$ , and  $\rho_0$  are the corresponding values at an arbitrary reference level at which  $h$  is assigned the value zero.

Eqs.(A2.) to (A10.) are applicable in the atmosphere where the escape into space of a constituent is not important. The hydrostatic Eq.(A2.) is based on the concept of LTE, i.e., collisions between particles are frequent enough so that there is a complete statistical exchange of particle energy and momentum in the volume under consideration. In the thermosphere the particles collide often enough to insure a Maxwellian velocity distribution and the existence of a meaningful kinetic temperature.



In the exosphere, above about 550 km, collisions are sufficiently reduced so that the existence of a Maxwellian distribution, and consequently, the validity of applying the hydrostatic relationship, must be examined anew. Liouville's theorem can be used to show that the Maxwellian velocity distribution present below the base of the exosphere applies equally well in the exosphere, provided that the escape of particles to space is negligible. The atmosphere is so rarefied in the exosphere that there is little solar radiation absorbed. Also, there are no energy loss mechanisms to disturb the Maxwellian velocity distribution. At the temperatures present, the distribution is disturbed only by the escape of neutral hydrogen from well above the base of the exosphere. It follows that the maximum altitude in the atmosphere where the hydrostatic equation is applicable can be determined by calculating the altitude in the exosphere where the density of the neutral hydrogen starts to be significantly affected by the escape of hydrogen atoms. Consequently, the greatest error involved in using the hydrostatic assumption will occur during the day near sunspot maximum conditions, inasmuch as temperatures are highest then. Calculations (Anderson and Francis, 1964) indicate that the error will start to become significant above about 5000 km altitude. For average sunspot conditions, the altitude is about 8500 km. For sunspot minimum conditions, the error will not be significant below 10,000 km.

Inasmuch as the atmosphere consists of a mixture of gases subject to a force field, the equilibrium distribution of its constituents can be expected to show some degree of diffusive separation. Although turbulent mixing below 100 km does not allow the development of diffusive equilibrium distributions, above this altitude there is experimental evidence that

diffusive equilibrium does exist. In the geopotential field, diffusive equilibrium gives concentration distributions for neutral particles that vary exponentially with the geopotential, with a more rapid decrease in concentration with increasing geopotential for the heavier constituents in the atmosphere than for the lighter. The result is a static distribution of gas constituents under the action of the external force field, which may be expressed by the barometric law Eq. (A8.) that applies for each atmospheric constituent independently of the others.

The concept that the atmosphere extending above 400 km over a given location on the earth's surface is isothermal in the sense that the temperature does not vary with altitude is now well established. In the tenuous gas of the upper thermosphere the thermal conductivity is independent of the pressure while the heat capacity varies linearly with density. Consequently, the conductivity is very large compared to the heat capacity. Above 400 km, the absorption of energy is negligible and the relatively high heat conductivity eliminates temperature differences; hence the kinetic temperature is nearly constant with altitude for many thousands of kilometers. The kinetic temperature can only be determined for a gas with a Maxwellian velocity distribution. As pointed out under the discussion of the accuracy of the hydrostatic assumption, the Maxwellian velocity distribution applies in the exosphere provided that the escape of particles to space is negligible. For hydrogen, the escape of atoms is comparatively rapid so that the velocity distribution in the upper exosphere beyond 10,000 km is not Maxwellian. Therefore, the hydrogen atoms in the upper exosphere have a non-Maxwellian distribution that becomes more pronounced with altitude.

Under these circumstances the concept of kinetic temperature is not entirely applicable, although an effective temperature can be defined by considering the average energy of the hydrogen atoms (Sharp, 1962).

Variation of upper-atmosphere properties and composition with the solar cycle. A principal problem connected with atmospheric structure is to calculate accurate values for all the primary properties in the heterosphere (above 90 km) as a function of time, location, and date by taking into account the relevant processes. The primary atmospheric properties are temperature, pressure, density, and mean molecular mass (or composition). To account for their variations, the following factors must be considered: (a) time (hour, day, sun-rotation period, season, year, sunspot cycle); (b) location (altitude, latitude, longitude); (c) solar characteristics (ultraviolet radiation, solar plasma and associated magnetic storms); and (d) particle processes (conduction, diffusion, mass transport, photoionization, dissociation, recombination, particle escape into space). The problem of describing upper atmospheric behavior is difficult because many of the above elements are interrelated.

The magnitudes of the atmospheric properties in the upper atmosphere are derived from measurements made from satellites, rockets, meteor observations, sky emissions, and the propagation of sound and radio waves. The data are sparse and contain much uncertainty above 200 km. The density (drag) data resulting from tracking satellites are the most precise, and by far, the most numerous. Study of the orbital decay data has clearly established that two major systematic density variations occur: (1) a solar activity effect in which variations in atmospheric heating and density take place above 90 km due to variations in solar

ultraviolet radiation; and (2) a diurnal (time-of-day) effect, in which the solar heating results in the atmosphere bulging toward the sun, producing relatively large density increases at altitudes above 300 km in the sunlit region of the earth. At 800 km, due to effect (1), the density can be 40 times as high during solar maximum conditions than during solar minimum, and due to effect (2), 15 times as high during the day than during the night. The combination of both (1) and (2) can result in densities 500 times as high at 800 km during solar maximum (day) than during solar minimum (night). This extreme variability in density also applies to pressure. Upper atmosphere density variations with latitude and season are much smaller than the two primary effects above. In addition, there is a conspicuous drag effect on satellites associated with major magnetic storms and the resulting heating is such that the relative effect on density increases with altitude. At present, it is not possible to make more than a rough estimate of the effect of magnetic heating on the density; fortunately, major magnetic storms are fairly rare and the associated heating is transient.

Upper-atmosphere measurements are not made on a regular enough basis, either in kind, time or space, to allow them to be used alone, without the aid of a model, to represent atmospheric conditions. The approach followed by most models used to derive atmospheric properties is to assume altitude profiles for some of them in order to calculate the remainder. Almost all the models deal with data referring only to density, pressure and/or temperature. The altitude variation of the mean molecular mass is introduced somewhat arbitrarily and, therefore, a physically

consistent vertical distribution of the composition cannot be obtained. A new method has been devised for computing atmospheric properties (Anderson and Francis, 1964). In this model, no major assumptions are made regarding the property profiles. Instead, the primary properties are calculated by starting with an empirical density profile from a density model as the chief input, assuming diffusive equilibrium conditions above 110 km and isothermal conditions with altitude above 400 km. The density profile, used as starting input for this new property model, is represented in a previous empirical model (Anderson, 1964) as a function of local time and solar activity from 200 to 800 km. This density model can be used to calculate the marked variations in density that occur from day to day by taking corrected values of the 10.7-cm solar flux (called  $S'$ ) as an index of the sun's extreme ultraviolet radiation. The remaining properties are derived by using the hydrostatic equation and equation of state, that relate density, pressure, temperature, and mean molecular mass as a function of altitude (Eqs. (A8.) to (A10.), together with boundary values based on measurements.

The equations embodying the model are programmed for an IBM-7090 computer. The results of the computations made from the model are given in two tables that present the neutral atmospheric properties and composition vs. altitude from 100 to 10,000 km. Tables A-4 and A-5 exhibit the properties and number densities of the various constituents vs. altitude near sunspot maximum and near sunspot minimum, respectively. The  $S'$  value used for Table A-4 ( $S' = 250$ ) is an average value for September, 1959, the month immediately following the Argus high-altitude

nuclear detonation. The  $S'$  value used for Table A-5 ( $S' = 44$ ) is an average value for July and August, 1962 ( $S' = 42$  for July;  $S' = 46$  for August), the two months following the Starfish high-altitude shot. Both tables are for  $t = 21$  hr.; the density for this time has been found to closely approximate the diurnally averaged density or the sum of the densities for every hour of the day divided by 24. Calculations of density from the model are based on neutral particles only. The ions do not contribute significantly to the total (ambient) density below 2000 km. Above this altitude, the contribution of  $H^+$  should be taken into account in any calculation of the ambient density. The neutral density is corrected for the departure from a Maxwellian velocity distribution caused by the escape of atomic hydrogen from the earth's exosphere. The temperature used to calculate the total pressure in the exosphere from A-5 is the kinetic temperature that is assumed to be locally isothermal vertically to 10,000 km. Hence, the computed pressure will be somewhat higher than the ambient pressure (a function of the effective temperature) of the neutral constituents above about 5000 km.

TABLE A-4. Upper atmosphere neutral properties versus altitude near sunspot maximum

Altitude h (km)	Temp. T (°K)	Scale height h <sub>s</sub> (km)	Mean rel. wt.	Concent. n (cm <sup>-3</sup> )	Pressure (dynes cm <sup>-2</sup> )	Density (gm cm <sup>-3</sup> )	n(H) (cm <sup>-3</sup> )	n(H <sub>2</sub> ) (cm <sup>-3</sup> )	n(O) (cm <sup>-3</sup> )	n(N <sub>2</sub> ) (cm <sup>-3</sup> )	n(O <sub>2</sub> ) (cm <sup>-3</sup> )	n(A) (cm <sup>-3</sup> )
100	230	7	28.43	1.07(13)*	3.40(-1)	5.05(-10)	4.17(5)	3.78(8)	6.81(11)	7.03(12)	2.88(12)	1.05(11)
120	330	12	27.15	7.28(11)	3.82(-2)	3.28(-11)	3.22(4)	7.05(7)	1.27(11)	3.81(11)	2.14(11)	4.73(9)
140	583	20	25.48	1.34(11)	1.08(-2)	5.66(-12)	2.07(4)	3.80(7)	3.85(10)	6.48(10)	3.00(10)	4.51(8)
160	796	29	24.11	4.33(10)	4.76(-3)	1.73(-12)	1.46(4)	2.44(7)	1.66(10)	1.89(10)	7.45(9)	8.87(7)
180	969	38	22.98	1.86(10)	2.62(-3)	7.48(-13)	1.17(4)	1.81(7)	9.13(9)	7.64(9)	2.81(9)	2.65(7)
200	1080	44	22.02	1.08(10)	1.61(-3)	3.96(-13)	1.03(4)	1.49(7)	5.80(9)	3.75(9)	1.26(9)	1.08(7)
240	1165	52	20.38	4.40(9)	7.07(-4)	1.49(-13)	9.18(3)	1.18(7)	2.83(9)	1.17(9)	3.36(8)	1.96(6)
300	1182	59	18.51	1.48(9)	2.42(-4)	4.56(-14)	8.56(3)	9.33(6)	1.17(9)	2.44(8)	5.65(7)	2.11(5)
340	1183	63	17.62	7.72(8)	1.26(-4)	2.26(-14)	8.25(3)	8.07(6)	6.57(8)	8.87(7)	1.78(7)	4.95(4)
400	1183	68	16.69	3.05(8)	5.05(-5)	8.56(-15)	7.82(3)	6.52(6)	2.80(8)	1.99(7)	3.21(6)	5.86(3)
500	1183	75	15.59	7.61(7)	1.24(-5)	1.97(-15)	7.17(3)	4.60(5)	6.96(7)	1.74(6)	1.95(5)	1.81(2)
600	1183	84	14.26	2.15(7)	3.51(-6)	5.08(-16)	6.53(3)	3.28(6)	1.80(7)	1.64(5)	1.33(4)	6.17
700	1183	102	12.09	7.23(6)	1.81(-6)	1.45(-16)	6.01(3)	2.36(6)	4.04(6)	1.65(4)	9.64(2)	
800	1183	137	9.28	3.08(6)	5.02(-7)	4.74(-17)	5.55(3)	1.72(6)	1.35(6)	1.76(3)	7.51(1)	
900	1183	192	6.82	1.66(6)	2.70(-7)	1.62(-17)	5.13(3)	1.26(6)	3.90(5)	2.01(2)	6.27	
1000	1183	253	5.32	1.05(6)	1.72(-7)	9.30(-18)	4.75(3)	9.32(5)	1.17(5)	2.43(1)		
1400	1183	372	4.01	3.06(5)	4.99(-8)	2.04(-18)	3.57(3)	3.01(5)	1.27(3)			
2000	1183	444	3.90	7.01(4)	1.14(-8)	4.53(-19)	2.44(3)	6.76(4)	3.24			
4000	1183	915	2.91	2.56(3)	4.18(-10)	1.23(-20)	9.33(2)	1.62(3)				
6000	1183	2301	1.64	6.07(2)	9.91(-11)	1.66(-21)	4.77(2)	1.30(2)				
10,000	1183	6128	1.08	1.97(2)	3.25(-11)	3.57(-22)	1.94(2)	5.31				

\*Denotes n = 1.07 x 10<sup>13</sup> particles cm<sup>-3</sup>

TABLE A-5. Upper atmosphere neutral properties versus altitude near magnetic minimum

Altitude h (km)	Temp. T (°K)	Sonic ht. (km)	Mean mol. wt.	Conc. n (cm <sup>-3</sup> )	Pressure (dynes cm <sup>-2</sup> )	Density (gm cm <sup>-3</sup> )	n (H) (cm <sup>-3</sup> )	n (He) (cm <sup>-3</sup> )	Constituent concentrations n (O) (cm <sup>-3</sup> )	n (N <sub>2</sub> ) (cm <sup>-3</sup> )	n (O <sub>2</sub> ) (cm <sup>-3</sup> )	n (A) (cm <sup>-3</sup> )
100	206	6	28.22	1.04 (13)	2.94 (-1)	4.86 (-10)	7.46 (5)	1.55 (6)	4.83 (11)	8.00 (12)	1.82 (12)	6.64 (10)
120	287	9	27.22	5.31 (11)	2.11 (-2)	2.40 (-11)	1.12 (5)	1.21 (7)	5.85 (10)	4.04 (11)	6.78 (10)	1.39 (9)
140	418	14	25.72	6.37 (10)	3.67 (-3)	2.72 (-12)	7.21 (4)	6.40 (6)	1.40 (10)	4.40 (10)	5.68 (9)	6.96 (7)
160	595	22	24.28	1.46 (10)	1.18 (-3)	5.88 (-13)	4.92 (4)	3.81 (6)	4.84 (9)	8.79 (9)	9.47 (8)	7.97 (6)
180	740	29	23.03	5.19 (9)	5.30 (-4)	1.96 (-13)	3.76 (4)	2.63 (6)	2.23 (9)	2.70 (9)	2.54 (6)	1.63 (6)
200	876	35	21.95	2.40 (9)	2.84 (-4)	8.75 (-14)	3.16 (4)	2.04 (6)	1.24 (9)	1.07 (9)	9.03 (7)	4.64 (5)
240	969	44	20.18	7.76 (8)	1.04 (-4)	2.60 (-14)	2.66 (4)	1.48 (6)	5.08 (8)	2.48 (8)	1.73 (7)	6.06 (4)
300	1004	51	18.24	2.13 (8)	2.96 (-5)	6.46 (-15)	2.40 (4)	1.10 (6)	1.72 (8)	3.82 (7)	2.04 (6)	4.24 (3)
340	1007	55	17.36	9.99 (7)	1.39 (-5)	2.88 (-15)	2.30 (4)	9.28 (5)	8.68 (7)	1.16 (7)	5.24 (5)	7.74 (2)
400	1008	59	16.47	3.46 (7)	4.82 (-6)	9.45 (-16)	2.16 (4)	7.21 (5)	3.18 (7)	2.00 (6)	7.04 (4)	6.30 (1)
500	1008	65	15.32	6.94 (6)	9.51 (-7)	1.74 (-16)	1.95 (4)	4.80 (5)	6.32 (6)	1.15 (5)	2.69 (3)	1.06
600	1008	76	13.50	1.62 (6)	2.25 (-7)	3.63 (-17)	1.76 (4)	3.23 (5)	1.27 (6)	7.17 (3)	1.13 (2)	
700	1008	102	10.36	5.03 (5)	7.08 (-8)	8.75 (-18)	1.60 (4)	2.29 (5)	2.73 (5)	4.83 (2)	5.16	
800	1008	154	7.04	2.26 (5)	3.15 (-8)	2.66 (-18)	1.45 (4)	1.51 (5)	6.10 (4)	3.51 (1)		
900	1008	223	4.99	1.32 (5)	1.84 (-8)	1.10 (-19)	1.33 (4)	1.05 (5)	1.42 (4)	2.74		
1000	1008	282	4.05	8.91 (4)	1.24 (-8)	6.00 (-19)	1.21 (4)	7.36 (4)	3.44 (3)			
1400	1008	412	3.08	2.82 (4)	3.93 (-9)	1.44 (-19)	8.69 (3)	1.95 (4)	1.71 (1)			
2000	1008	692	2.13	8.98 (3)	1.25 (-9)	3.18 (-20)	5.99 (3)	3.39 (3)				
4000	1008	2120	1.07	1.88 (3)	2.62 (-10)	3.34 (-21)	1.84 (3)	4.26 (1)				
6000	1008	3186	1.01	8.56 (2)	1.19 (-10)	1.43 (-21)	8.54 (2)	2.20				
10,000	1008	5637	1.00	3.10 (2)	4.31 (-11)	5.15 (-22)	3.10 (2)					

\* Denotes  $n = 1.04 \times 10^{13}$  particles cm<sup>-3</sup>



## References

- Anderson, A.D., 1964: On the inexactness of the 10.7-cm flux from the sun as an index of the total extreme ultraviolet radiation. J. Atmos. Sci., 21, 1-14.
- Anderson, A.D., and W.E. Francis, 1964: A semi-theoretical model for atmospheric properties from 90 to 10,000 km. Lockheed Missiles and Space Company Rep. No. 6-74-64-19 (AD-600 472).
- Bandeem, W., M. Halev, and I. Strange, 1965: A radiation climatology in the visible and infrared from the Tiros meteorological satellites, NASA Technical Note TN D-2534, Washington, D.C., 13-17.
- Bourdeau, R.E., and S.J. Bauer, 1963: Structure of the upper atmosphere deduced from charged particle measurements on rockets and the Explorer VIII satellite. Space Research III, Interscience Pub. Inc., New York, p. 173.
- Bray, J.R., 1959: An analysis of the possible recent changes in the atmospheric carbon dioxide concentration. Tellus, 11, 220-230.
- Cole, A.E., and A.J. Kantor, 1963: Air Force interim supplemental atmospheres to 90 km. Air Force Cambridge Res. Lab. Surveys in Geophysics No. 153.
- Glueckauf, E., 1944: Carbon dioxide content of the atmosphere. Nature, 153, 620-621.
- Götz, W.P., 1951: Ozone in the Atmosphere, Compendium of Meteorology, T.F. Malone (Ed.), American Meteorological Society, Boston, Mass, pp. 275-291.
- Gutnick, M., 1962: Mean moisture profiles to 31 km for middle latitudes, Geophysical Research Directorate Interim Notes on Atmospheric Properties, No. 22, Air Force Cambridge Research Laboratories, Waltham, Mass.
- Johnson, F.S., 1960: The composition of outer space. Astronautics, 5, 31.
- Miller, L.E., 1960: Atmospheric composition, Chapter 8 in Handbook of Geophysics, C.F. Campen, Jr. (Ed.), Macmillan, New York.
- Nicolet, M., 1961: Helium, an important constituent in the lower thermosphere. J. Geophys. Res., 66, 2263.
- Sharp, G.W., 1962: The concept of temperature in the upper atmosphere. Temperature - its measurement and control in science and industry, 3, part I, Reinhold Pub. Corp., New York, p. 823.
- U.S. Standard Atmosphere, 1962: U.S. Govt. Print. Off., Washington, D.C.